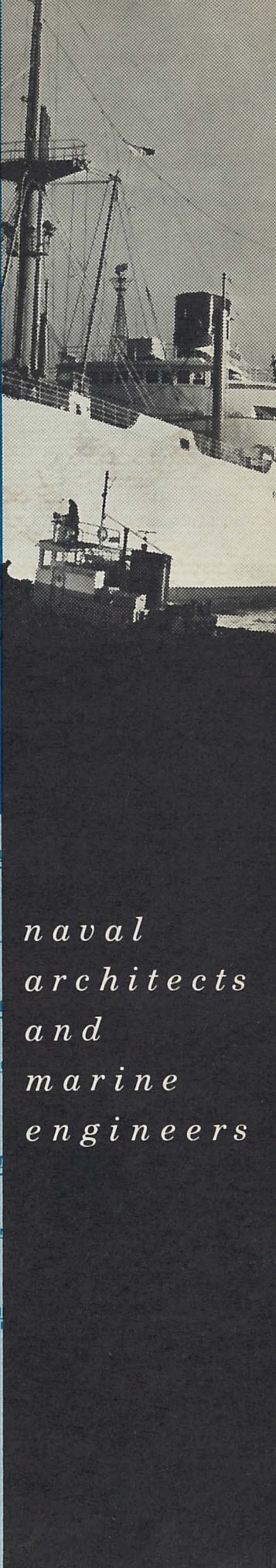
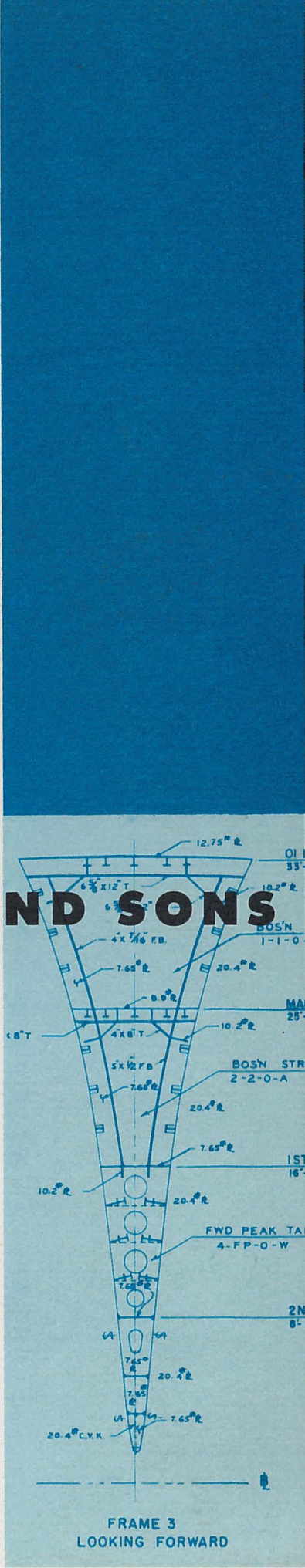


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**SPECIFICATION
NO. 2178**

For the Construction of

**Oceanographic & Fisheries
Research Vessel**

USFWS "TOWNSEND CROMWELL"

For

United States

**BUREAU OF COMMERCIAL FISHERIES
U. S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR
HONOLULU, HAWAII**

Designed by

**W. C. NICKUM & SONS CO.
71 COLUMBIA STREET
SEATTLE, WASHINGTON**

August 10, 1962

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SECTION I - GENERAL

GENERAL DESCRIPTION OF VESSEL

The vessel is designed for use as an oceanographic and fisheries research vessel to be used primarily in the waters of the Pacific Ocean. The vessel will operate the majority of the time in tropical waters, with occasional trips to the North Pacific. Construction will be of welded steel throughout, with transverse framing forward of Frame 15 and longitudinal framing aft of Frame 15.

The main deck, forecastle deck, and the top of the deck houses will have both sheer and camber. The lower deck will have sheer only. Fuel oil and ballast deep tanks will be arranged below the lower decks as shown. Fore and aft subdivision will be provided by transverse watertight bulkheads extending from the keel to the main deck. The bulkhead at Frame 20 will be fitted with a sliding watertight door to allow access between crew's quarters and the ship's storage spaces.

The bulkhead at Frame 28 at the after side of the machinery space will be fitted with a bolted plate for use in shipping or unshipping machinery through the hatch over the after storage compartment.

Space below the platform deck will be fitted at the extreme forward end with a bow observation chamber, with ballast tanks, oil tanks, and with stores spaces as shown. Space above the platform deck will be fitted with refrigerated and dry storage spaces, and passenger accommodations. The space aft of the machinery space below the main deck will be fitted out as the steering gear compartment, engineer's workshop, and for the stowage of scuba gear and general deck gear.

The forecastle deck will enclose a boatswain's locker, a refrigeration-compressor machinery space, and general fishing gear stowage. The well deck will be fitted with a trawl winch, a long line hauler, fair leads, masts and booms, and fittings for mooring and for fishing. The main deck house will enclose laboratories, crew's quarters, the ward room and galley. The forecastle deck will be fitted with the anchor windlass, gas drum stowage and mooring and anchor fittings. The boat deck will be fitted with the hydrographic and plankton winches, the bathythermograph winches, life boats, inflatable life rafts, quadrupod mast, stack and emergency generator. The boat deck house will enclose the scientific information center, hospital, captain's quarters and radio room. The pilot house will be forward of the boat deck house

at a raised level.

The vessel will be fitted with power steering, electrically driven windlass, and with electro-hydraulic topping lift winches for the forward cargo gear, electric trawl winch, electro-hydraulically operated hydrographic and plankton winches, electric bathythermograph winches, and an electric boat winch for the life boat. Bilge and ballast, fuel oil filling, transfer and service, sounding and air escapes, fire main, sanitary water, hot and cold potable water, deck and plumbing drainage, lubricating oil, exhaust, and circulating water piping systems will be installed as described elsewhere herein.

The vessel will be designed to operate in climates having air temperatures of plus 10° F. and water temperatures of plus 28° F. and, in addition, will be prepared to operate in climates having air temperatures of plus 90° and water temperatures of plus 86° F. Heating and cooling of quarters will be required for both these conditions.

The vessel will be propelled by diesel engines through twin controllable pitch propellers. Not less than 400 brake horsepower will be supplied to each propulsion shaft. The machinery plant is to be complete with pumps, tanks, compressors, switchboards, distillers, control gear, etc., as required for a complete installation.

Four generators will be provided for operation of all

necessary auxiliaries. General and emergency lighting systems, power distribution system, and interior communication systems shall be provided as elsewhere described.

DIMENSIONS

Length over-all	158'-6"
Length load water line	147'-0"
Length scantling	142'-8"
Beam, molded	33'-0"
Beam, extreme	33'-1-1/2"
Depth low point of sheer	14'-6"
Draft, mean from molded keel line	9'-6"
Draft, maximum - forward over bulb	11'-6-3/8"
Draft, Maximum - aft over keel	9'-6-7/16"

CAPACITIES

Fuel Oil	40,000 gallons (approx.)
Potable Water	8,000 gallons (approx.)

COMPLEMENT

Captain	1
Mates	3
Chief Engineer	1
Assistant Engineers	3
Seamen-Fishermen	6
Boatswain	1
Radio Man	1
Cook	1
Mess Boy	1
Total Ship's Crew	<u>18</u>
Scientists	7
Total Complement	<u>25</u>

INTENT OF SPECIFICATIONS

It is to be distinctly understood that it is intended by the Owners to receive from the Contractor a vessel constructed by approved methods fitted in all respects to operate economically as an oceanographic and fisheries research vessel throughout the waters of the world and to have embodied in its construction the practices used in building modern vessels of this class. No inadvertent omission in the plans, specifications and other necessary data for the satisfactory operation and seaworthiness of the vessel within the intent of these specifications and in accordance with the best marine practices shall operate to the disadvantage of the Owners. The intent of these specifications and of the plans accompanying them is to describe the vessel complete in every respect in accordance with modern practice for an oceanographic and fisheries research vessel of this type. It is not, however, the intention to specify every detail; therefore any errors in the description or the omission of any item in the specifications or plans needed to complete the vessel ready for service to the satisfaction of the Owners, with the exception of specified items to be furnished by the Owners, will not relieve the builders from furnishing such equipment and outfitting in full. Wherever the words

"as approved", "as required", "to approval", etc., are used herein, the decision of the Owner is intended.

Wherever the term "Owner" appears it shall be taken to mean the U. S. Department of Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries, represented by its duly appointed contracting officer or his authorized representative.

Descriptive information on items referred to by Military Specifications, Federal Specifications or Federal Stock Numbers may be obtained from the Business Service Center, General Services Administration, located in the following cities: Boston, Massachusetts; New York, New York; Washington, D.C.; Atlanta, Georgia; Chicago, Illinois; Kansas City, Missouri; Dallas, Texas; Fort Worth, Texas; Denver, Colorado; Los Angeles, California; Seattle, Washington.

CLASSIFICATION

The vessel, together with its machinery and equipment, shall be built to the classification +AI and +AMS and under the special survey of the American Bureau of Shipping. Complete classification and test certificates, etc., from the ABS are to be

delivered by the Contractor to the Owner upon completion. The cost of classification shall be borne by the Contractor. Provision of anchor gear to obtain the equipment letter "E" and "Certification of Cargo Gear" will not be required.

U. S. COAST GUARD

The vessel is to be built to the inspection and to the requirements of the U. S. Coast Guard for "oceanographic" service. A Coast Guard certificate for operation will not be required, but the Contractor will be required to provide a letter from the U. S. Coast Guard stating that the vessel has been built under the inspection of and to the approval of the U. S. Coast Guard. The Coast Guard has no specific formal regulations for this type of vessel. They do require, however, that the subdivision and stability of the vessel meet passenger ship requirements. Otherwise, requirements of CG-257 "Rules and Regulations for Cargo and Miscellaneous Vessels" are applicable. The contract plans and specifications have been approved by the Coast Guard.

PUBLIC HEALTH SERVICE

The vessel shall comply with the regulations of the U.S. Public Health Service for ratproofing, sanitation, etc., with the

exception of the installation of the potable water in skin tanks. This requirement of the Public Health Service is hereby expressly waived.

INSPECTION

The vessel shall be constructed and equipped under the inspection of and subject to the approval of representatives of the Owner, the American Bureau of Shipping, the U. S. Coast Guard and the U. S. Public Health Service.

All material and workmanship shall be subject to inspection by representatives of the above agencies at any and all times during manufacture or construction. The inspectors shall be advised of the progress of construction and shall be provided with free access at all times to any part of the construction activity.

Failure of the Owner during progress of the work to discover materials or workmanship not in accordance with the specifications and drawings shall not be deemed or accepted as a waiver of defects therein. No payment or partial payment shall be construed as acceptance of work or materials not in strict accordance with the specifications.

The Owner will retain an architectural firm to act as their representative during construction. The authority of this

firm and their inspectors will be delegated by the Owners and will be limited to supervision and inspection of construction and interpretation of the requirements of the plans and specifications.

The Contractor is to provide office facilities, with a telephone for local use, at his plant for use of the Owners and Inspectors. In addition, the Contractor is to provide clerical service for typing letters, reports, etc., to the Owner's Inspectors. The Contractor shall at all reasonable hours furnish facilities for inspection as may be required by the American Bureau of Shipping, the U. S. Coast Guard, and U. S. Public Health Service.

ACCESS

Arrangements for examination, for access, and for cleaning and painting shall be provided for all compartments and all pockets in the vessel by means of permanent ladders, doors, manholes, scuttles, bolted plates, etc. All battens in holds, store rooms and other spaces, and all protective casings around pipes, and all sheathing shall be made readily removeable for this purpose. Provision shall also be made by means of bolted plates, portable sections of beams, stiffeners and otherwise as necessary to allow dismantling, etc., for overhaul. Emergency access for living and working spaces shall be provided as required

by the U. S. Coast Guard.

WORKMANSHIP

The workmanship shall be first class throughout.

Particular care shall be taken to see that the surfaces of hull and houses shall be smooth and free from warps, bubbles and distortions.

All piping, electrical and ventilation work shall be carefully and neatly laid out to present a neat, finished appearance; particularly in areas where they are not concealed by sheathing.

Sharp or ragged edges of exposed work in rails, access openings, hatches, etc., where injury to personnel or equipment might occur shall be chipped and ground smooth.

Care shall be taken during the final stages of construction by means of portable covers, etc., to protect finished surfaces of furniture, sheathing, deck covering, etc., from being marred or otherwise damaged.

MATERIALS

All materials required for the completed vessel except as specified elsewhere herein are to be provided by the Contractor.

In general, throughout the specifications, the basic materials have been specified. In connection with details, however, where it is not practical to set forth exact specifications it is understood that materials conforming to first class commercial practice and suitable for the purpose intended are to be furnished.

In accordance with the requirements of Clause 9 (a) of the general provisions of the contract, the Contracting Officer will require full information concerning material or articles which the builder contemplates incorporating in the work. The Contracting Officer, in determining whether equipment is equal to that specified will require not only full information concerning the equipment, but evidence that the equipment has seen actual service on ships for a period of at least three years and that it will give the trouble free life and service required.

Material and equipment shall be guaranteed to the Contractor and to the Owners for successful operation under the required tests and the period in service as specified under the guarantee.

CARE OF THE VESSEL

Prior to closing up any inaccessible space or tanks

during the course of construction they shall be thoroughly cleaned to the satisfaction of the Owner's representative. Special care shall be taken in the cleaning of the lubricating oil tanks and lines.

At the time of delivery the vessel, including all windows, must be thoroughly cleaned, and the finish coat of paint, as well as the finished surfaces of furniture, must be clean in new unmarred condition. All bilges shall be clean and free from shipyard debris.

GUARANTEE

The Contractor shall guarantee all parts, material, equipment and workmanship entering into the vessel and furnished by him or on his account against defects in material or workmanship, or latent defects which may develop within six months after delivery of the vessel to the Owners. Any items of material, equipment or workmanship found defective or found not to operate in accordance with the requirements of the specifications shall be replaced by the Contractor without expense to the Owner. In the event immediate repairs or replacements are essential to keep the vessel in scheduled operation these repairs will be made by the Owners and billed to the Contractor. If immediate repairs are not necessary the Contractor will be notified and given five days to examine and correct the defects. If the defects are not corrected within this period the Owners will correct them and bill the cost to the Contractor.

WEIGHT, STABILITY AND TRIM

Weight is important in the construction of the vessel. Every effort is to be made by the Contractor to eliminate any unnecessary weight. This will be done by sniping outstanding flanges, burning lightening holes, etc., and by using only the lightest material

consistent with the basic design.

INCLINING EXPERIMENT

Upon completion of the vessel the builder will incline it and furnish a report of the experiment as required by the U. S. Coast Guard.

LAUNCHING

The builder will exercise care in laying out cradle and launching ways to see that no undue strains are imposed on the hull during launching.

DOCKING

In the event the lapse of time between the launching and delivery of the vessel is more than sixty (60) days the builder will dry dock the vessel and clean and apply one new coat of anti-fouling paint on the bottom at his own expense just prior to the trial trip.

OWNER FURNISHED MATERIAL

The following items will be furnished by the Government:

- (1) One hydrographic winch, one plankton winch, and one winch hydraulic package as specified in Section 20.

- (2) Two bathythermograph winches (See Section 20)
- (3) One Edo, sonar sounding set with transducers (See Section 67)
- (4) One Radar, Sperry Piedmont Co., "Mark 3", with antenna
(See Section 67)
- (5) One Loran set - Sperry Piedmont, "Mark 2", Mod. 2A
(See Section 67)
- (6) One Simrad depth finder, with transducer (See Section 67)
- (7) Radio transmitting and receiving equipment (See Section 67)
- (8) One gyro compass system (See Section 65)
- (9) One temperature and conductivity meter (Section 67)
- (10) One 18-person, 185 cu. ft. life boat, aluminum
(See Section 82)
- (11) One pair of Crescent life boat davits (See Section 82)
- (12) One hand life boat winch (See Section 82)
- (13) One long line hauler (See Section 20)
- (14) One wind direction and speed indicating system (See Section 65)
- (15) One engine room chain hoist (See Section 12)
- (16) One gasoline drum (See Section 15)
- (17) One clinometer (See Section 24)
- (18) Ten clocks for Contractor mounting (See Sections 24, 32,
33 and 34)
- (19) One Barograph (See Section 32)

- (20) Two machinist vises (See Section 82)
- (21) One set of wire for trawl winch (See Section 20)
- (22) One line throwing gun (See Section 82)
- (23) One set of life preservers
- (24) One set of Manila hawsers and mooring lines (See Section 26)
- (25) All portable navigating equipment
- (26) Deck Outfit - i.e., spare blocks, lines, fenders, etc.
- (27) Cleaning gear - mops, pails, etc.
- (28) Galley and messing utensils, pots and pans
- (29) Medicine chest
- (30) Bedding and linen
- (31) Fishing gear
- (32) All portable tools and spare parts, except as specifically called for elsewhere herein
- (33) One portable pump set for draining refrigerated spaces.
- (34) One gas mask (for Freon)
- (35) Wash down hose (deck use)
- (36) Manila Cargo Falls for forward booms
- (37) Vises for work benches
- (38) One Stokes litter (See Section 37)

CARE OF OWNER FURNISHED MATERIAL

Articles which are furnished by the Owner will be delivered by truck or rail at the nearest point to the Contractor's works. The Contractor shall accept such consignments when tendered, give receipts therefor, and assume responsibility for same. If part of a consignment is missing, damaged, or not according to invoice the Contractor shall notify the Owner immediately. The Contractor shall unload all such consignments, store and care for them as required. The Contractor shall fit, install, or stow all Owner-furnished items, and deliver them to the Owner with the vessel in a condition equal to that in which they were received.

CONTRACT PLANS

The following plans are attached hereto and form a part of the specifications. Any work to be done or articles to be furnished as mentioned or implied in these specifications which is not shown on the drawings, or which is shown on the drawings and not mentioned in the specifications is to be done and cared for as if mentioned in either or both.

One reproducible copy of each plan and of the specifications will be furnished the Contractor for his use during construction.

WCN&S Dwg. #TITLE

2178 -	SO1-1	Alt. 1	"Outboard Profile"
	S01-2	"	"Arrangement Lower Deck & Hold"
	SO1-3	"	"Arrangement Main & Upper Decks & Pilot House"
	SO5-1	"	"Lines"
	S11-1	"	"Deck Structure"
	S11-2	"	"Structural Profile and Typical Sections"
	S11-4	"	"Shell Expansion and Framing"
	S11-5	"	"Deck House"
	S11-6	"	"Midship Section"
	S12-1	"	"Aft Quadrupod, Hydrographic Boom and Platform Arrangement"
	S21-1	"	"Hydraulic System Piping Diagram"
	S22-1	"	"Arrangement of Steering Compartment, Steering Gear and Shafting"
	S23-1	"	"Gallows Frames"
	S32-1	"	"Laboratories - Arrangement & Detail"
	S34-1	"	"Galley Arrangement & Details"
	S38-1	"	"Ventilation, Heating & Air Conditioning Duct & Piping Diagrams"
	S41-1	"	"Arrangement of Machinery"
	S45-1	"	"Lubricating Oil Systems Piping Diagram"
	S48-1	"	"F.W. & S.W. Cooling, Aquaria and Bilge & Ballast Systems - Piping Diagram"
	S48-2	"	"Fire & Washdown Systems - Piping Diagram"
	S48-3	"	"Fresh Water & Sanitary Salt Water - Piping Diagram"
	S48-4	"	"Sounding, Vent & Overflow Piping - Diagram"
	S48-5	"	"Drainage Systems - Piping Diagram"
	S49-1	"	"Compressed Air Piping Diagram"
	S55-1	"	"Fuel Oil Transfer & Service System - Piping Diagram"
	S62-1	"	"Electrical System - Elementary Wiring Diagram"
	S62-2	"	"Power System Deck Plan - Lower Decks"
	S62-3	"	"Power System Deck Plan - Upper Decks"
	S64-1	"	"Lighting System Deck Plan - Lower Decks"
	S64-2	"	"Lighting System Deck Plan - Upper Decks"
	S64-3	"	"Running Anchor & Signal Lights - Deck Plan"
	S65-1	"	"I.C. Systems - Elementary Wiring Diagram"
	S65-2	"	"I.C. Systems Deck Plan - Lower Decks"
	S65-3	"	"I.C. Systems Deck Plan - Upper Decks"
	S93-1	"	"Fire Zoning, Insulation, Sheathing & Deck Covering"

In addition to the above plans of Intact and Damaged Stability, Subdivision and Curves of Form will be furnished the Contractor for reference.

BUILDER'S PLANS

The shipbuilder and his subcontractors and machinery suppliers are to supply such detail plans as may be required for construction and as will be required to secure approval of details by the American Bureau of Shipping, the U. S. Coast Guard and the Owners. The Owner will cooperate with the builder in order to develop a practical plan of procedure for approval in order to expedite the approval of plans insofar as possible.

Outline drawings, specifications, cuts, and/or descriptive literature are to be submitted to the Owner's representatives prior to purchasing standard items of machinery and equipment. While excessive details will not be required, the above drawings or literature must be specific enough to allow full understanding of the equipment to be supplied.

"AS BUILT" PLANS

On completion of the vessel the Contractor is to obtain a photographic tracing on cloth from his reproducibles of the contract plans and is to correct the tracings to suit the work as actually installed and deliver the tracings to the Owners.

The Contractor is also to prepare a standard commercial docking plan and to furnish a reproducible and two prints to the Owners. In addition, two prints of each plan prepared by the builder corrected to show the work as actually installed on the vessel is to be furnished to the Owners. One reproducible and two prints shall be furnished of plans showing tables of capacities for each inch of depth above the bottom of the sounding tube or strike plate.

INSTRUCTION BOOKS

Three (3) copies of standard commercial instruction books shall be provided for each item of machinery and equipment supplied by the builder. The books may be in loose leaf form, but shall include descriptive material--and in particular shall include sufficient information to allow the Owners to order replacement parts.

PROGRESS REPORTS AND PHOTOGRAPHS

The Contractor shall furnish to the Owner monthly progress reports indicating the state of fabrication and erection, the status of working plan approvals, material and equipment orders, materials and equipment on hand, etc. In addition to the written report and tabular data the report shall include each month three prints 8" x 10" and one photographic negative of at least one view of the construction of the vessel. After launching, in addition to one exterior view, three 8 x 10 prints and one negative shall be provided of one interior view. On completion, and prior to delivery, the Contractor shall furnish to the Owner three (3) 8 x 10 prints and one photographic negative of the vessel taken under way from a head-on, quartering, and broadside position.

GUARDS

Guards, safety rails, etc., are to be installed around all items of rotating machinery and shafting including Owner-furnished machinery where exposed moving parts are liable to cause injury to personnel.

Where insulated pipes are led close to the deck in areas where the covering is liable to be damaged by kicking or stepping on the pipe, light galvanized, perforated metal guards will be placed over the covering. Similarly, wherever pipes, cables or ventilation ducts are subject to mechanical damage whether by crew or by the operation of the vessel in fishing, doing actual oceanographic work, loading stores, etc., they are to be protected by sheet metal guards.

TESTS AND TRIALS

All tests required by the U. S. Coast Guard to obtain a certificate, and as required by the classification society will be performed by the Contractor.

During the course of construction the steel structure will be tested by water head and hose in accordance with the requirements of the American Bureau of Shipping

Hydrostatic tests will be given to all piping systems and shall be performed prior to insulation or painting. All electrical systems shall be measured and otherwise tested as required by the U. S. Coast Guard.

Upon completion of the ship and prior to dock and sea trials all auxiliary machinery, deck machinery, boat handling devices, ventilation, heating and cooling systems, piping systems and electrical systems shall be thoroughly tested to demonstrate their perfect working order and suitability for the work intended and to demonstrate further that all requirements of specifications and authorized changes have been fulfilled. These tests in general shall be operative tests simulating as near as possible the service to which the equipment will be put in the completed vessel.

The main machinery plant shall be tested at the dock by means of a dock trial of the length required by manufacturer's representatives to indicate that the installation is complete and that the machinery is in working order and ready for the sea trial.

At the time of the sea trial the fuel oil tanks, lubricating oil tanks and potable water tanks shall be full. The anti-rolling tank shall be filled to its normal operating level and as much water

ballast will be installed as possible to give the maximum submergence without excessive forward trim. The trial shall be conducted in deep water and during the time of the trials all machinery and equipment shall be operated and proved in satisfactory condition. Tests shall include but not be limited to the following:

(a) A four (4) hour full power run. During this time the propulsion engines shall be operated at their rated RPM and the propeller pitch adjusted to obtain the maximum horsepower from the engines. The four hour run shall be a continuous run, and should failure or non-performance of any component of the propulsion system require shutting down or losing power the trial shall be rerun to obtain the four hour operation without stopping or adjusting speed.

(b) Standardization trials. The vessel shall be run over an approved measured mile course to obtain a standardization curve of speed versus propeller pitch. The run shall extend from a speed of about 4 knots to the maximum. Engine RPM and propeller pitch shall be adjusted to demonstrate satisfactory performance of the vessel at speeds between zero and six knots, and a standardization card prepared for half-knot intervals.

(c) The backing performance of the vessel shall be demonstrated by making a crash stop and by recording distance and time to dead in the water.

(d) Turning trials shall be run to determine the turning circle of the vessel at full speed and to record the time from hard over to hard over to demonstrate the operating characteristics of the steering gear. Additional tests of the steering system shall be made as required by the U. S. Coast Guard and the American Bureau of Shipping.

(e) Anchor tests shall be run by anchoring the vessel in deep water with both the bower and the bow anchors.

Following completion of the trials any item of equipment which shows questionable operating characteristics are to be opened up, examined, and repaired, if necessary. If major repairs are necessary or the performance of the items of equipment are not up to specification requirements the trials are to be rerun until the equipment meets specification requirements.

On completion of the vessel and prior to delivery to the Owners magnetic compasses shall be adjusted by the Builders.

For tests and trials of the anti-rolling tanks see Section 29 of these specifications.

SECTION 11 - HULL STRUCTURE

GENERAL

The structural design of the hull contemplates all welded construction, and alternates for all riveted construction or combination riveted and welded construction will not be considered. Modifications in structural details, as shown on the Contract Plans, however, which may be desired by the Contractor to suit his yard practice, handling equipment, available materials, etc., will be given every consideration. Attention of the Contractor is invited, however, to the fact that any revisions must not only meet the approval of the American Bureau of Shipping and the U. S. Coast Guard, but must also maintain equivalent strength and resistance to vibration to the scantlings shown on the Contract Plans.

Scantlings of the hull structure are shown on the structural drawings of the Contract Plans. All details developed from the Contract Plans are to be carried out in accordance with best commercial standard practices, and will be subject to the approval of the American Bureau of Shipping, U. S. Coast Guard, and the Owner's Representatives. The erection sequence is to be so developed that a minimum of locked up stresses is encountered. The use of sections or panels prefabricated in the yard will be permitted in the erection of

the hull, subject to approval of the authorities and the Owner's Representatives of an erection and welding schedule.

Edge preparation for welding, welding sequence, types of rods, classification of welders, and welding workmanship, shall all be in accordance with the standards of the American Bureau of Shipping. Welding distortion shall be held to a minimum by sequence control, with shrinkage methods used only as a last resort for fairing up distorted and warped surfaces.

The workmanship shall be such as to insure fair lines and a smooth surface, attention being given to the neatness of structural brackets and clips, and to the sniping of angles when exposed to view.

Where steel castings are used in locations requiring flanges to be caulked oil-tight or water-tight, they shall have the edges and faying surfaces planed or ground so as to give a clean, smooth surface. Direct attachment of fittings to oil-tight structure shall be by welding only.

All burning of notches and holes in the structure is to be neatly and carefully done, and the finished cut is to be regular in outline, with the burr or bead removed. Sharp or ragged edges of exposed structural work, access holes, etc., where liable to injure

personnel or equipment, shall be removed. Outstanding flanges or stiffeners, brackets, etc., shall be sniped at 45° to save weight.

Trunks and coamings, in general, shall be worked with corners rounded to an appropriate radius. Cuts or openings in any structural member, or in any part contributing to the strength of any part of the hull, shall be worked to ample radii so as to eliminate stress concentration.

Where holes are cut in webs of channels or web frames for pipes, wiring leads and the like, they shall be cut from the central 1/3 of the web.

Hull structural members shall in general have corners sniped for drainage. Beams over oil tanks and longitudinals in tanks and bilges shall have vent holes burned in their tops every 24". Lightning holes in large members will be required only where necessary for drainage or access.

SHELL PLATING

Shell plating is to have the weights shown on the Contract Plans. Seams and butts are to be flish. Location of seams and butts generally have not been indicated and may be arranged by

the Contractor to suit his equipment and available material.

Fairness in shell plating is to be obtained by proper welding sequence and techniques.

Doubler plates are to be installed on the shell plating in the way of sea chests and other openings as required by the American Bureau of Shipping, and, in addition, a quarter inch doubler extending down to the waterline shall be fitted underneath the hawse pipe to take the chafing of the anchor.

Fenders as such will not be required, but it will be noted from the plans that the outside vertical plate in the hull from the forecastle deck aft is made of extra heavy steel to provide a fender surface.

The bulb bow shall be carefully formed and faired but for about the forward two-thirds length the bulb plating may intersect the shell in a knuckle and a fillet may be formed by filling in at the knuckle line with a suitable preparation of epoxy cement.

The cement fillet shall be carefully faired in at the after end to the hull plating so there will be no sharp breaks or discontinuities.

HULL FRAMING

The vessel is generally framed on the longitudinal system with transverse web frames, longitudinal stiffeners, longitudinal girders and stanchions. Scantlings are to be generally indicated in the Contract Plans. Beveling of the inner flange of web frames will not be required; however, in the latter case local beveling in the way of longitudinal flanges, girders, etc., is to be done where necessary for a proper connection. Forward of Frame 15 the vessel is to be framed transversely. The exact location of the break between longitudinal and transverse framing may be shifted by the Contractor to suit his erection procedures.

SKEG

A fabricated steel skeg shall be installed as indicated on the plan. The skeg shall be properly faired and connected to the shell plating and in development of longitudinal foundation members in the machinery space every effort shall be made to incorporate the side plating of the skeg into the foundation proper.

STERN TUBE AND STRUTS

Stern tubes may be of cast steel, heavy wall thickness pipe, or roll plated weldment. The tubes are to be properly

framed, are to be welded all around to the shell plating, and be fitted with proper webs and structural support.

Struts are to be of the size and general shape indicated in the Contract Plans. Struts are to be of cast steel or of forged weldments. In the event the latter method is selected by the Contractor radiographing treatment will be required of all welds. Stern tube arms shall extend through the shell plating and be secured to proper longitudinal and transverse framing members to distribute the strut load into the hull.

C. V. K., STEM, & LONGITUDINAL GIRDERS

The center vertical keel shall be continuous between watertight bulkheads. Top members shall be formed of welded steel plate. Continuity forward and aft shall be generally as indicated on the plans.

The stem shall be of formed plate throughout its upper area tapering into a 1" stem bar. The forming shall be carefully done and the stem bar rabbeted for 6" to provide a smooth, fair connection.

Longitudinal girders and longitudinal frame members may be intercostal between watertight bulkheads, but continuity shall

be developed in all girders to eliminate abrupt terminations at bulkheads and hard spots in the structure. In general engine foundation members shall be arranged to tie in to the longitudinal framing system.

DECK STRUCTURE

Deck plating on the lower, main, upper decks, and the house top shall be of steel supported on beams, webs and girders generally as indicated on the Contract Plans. All deck plating shall be flush welded. The main deck, forecastle deck, boat deck, upper deck, and house tops shall be watertight. The lower deck shall be oil-tight or watertight over tanks, but elsewhere may be nontight. The decks shall be supported by stanchions, and bulkheads. Care shall be taken in preparing the detail steel plans to insure proper continuity in the transmitting of loads through stanchions, etc.

The deck plating on the bridge wings shall be of conventional steel supported by beams, etc., all as indicated on the plans. The deck forming the pilot house floor inside of the pilot house over the void spaces below is to be constructed of "Ferrobord" as made by the Trucson Steel Co., or equal. "Ferrobord" is to be

of 18 gauge material, 1-1/2" deep. The decking is to be tack welded to supporting beams and to flat bars or angles around the edges of the pilot house. In way of steering stand, binnacle, radar, engine control stand and other items of equipment which must be secured to the deck, a 3/16" plate properly stiffened and supported to prevent vibration is to be installed level with the underside of the "Ferrobord" decking. Steel framing is to be provided as a support for the edges of the "Ferrobord" all around the pads and against the house. Fir pads 1-1/2" thick, 1" larger than the bases, are to be installed under equipment so that the pad and the top of the "Ferrobord" is level. The equipment is to be bolted through the pads and the steel plate supports. Watertightness will not be required on this deck.

DECK HOUSE SIDES AND FRONTS

All deck house sides and ends shall be of flush steel construction with angle or "T" stiffeners as shown on the Contract Plans, suitably framed around window, port, and door openings.

BULWARK

Steel bulwark shall be fitted around the main deck with a flattened pipe cap rail as indicated on the plans. Steel bulwark on bridge wings shall have a 5-1/2" x 2-1/2" teak rail cap.

FOUNDATIONS

The main propulsion engine and gears and the auxiliary generator foundations shall be of welded construction throughout; the foundations being designed as an integral part of the ship's structure rather than being superimposed. The main engines and gears shall be installed with finished steel or cast iron chocks approximately 1" thick between the foundation top plates and the engine. Each chock will be long enough to be held by at least two bolts; shall be accurately finished to hold the engines and gears in line without binding or cramping and with approximately equal loads on each. Gears and engines are to be secured by fitted bolts reamed after the engines and gears are lined up and chocked.

All foundations are to be welded steel with special attention being given to the rigidity of the foundations proper, and the cushioning of auxiliary machinery where it is liable to produce vibration with the consequent transmission of noise.

Top plates of pump, boiler and compressor foundations are to be flanged up to form drip pans and brass drain pipes are to be fitted in the plates.

To reduce transmission of fan noises all ventilating fans are to be mounted on rubber pads.

WATERTIGHT AND OILTIGHT BULKHEADS

The main bulkheads are to be flush plated with thicknesses of plating and stiffening by vertical stiffeners as indicated on the Contract Plans.

STEEL DIVISIONAL BULKHEADS

Steel divisional bulkheads shall be fitted around stair wells, toilet and galley spaces and other spaces indicated on the Contract Plans. Bulkheads shall be 3/16" plate stiffened by light angle stiffeners. Bulkheads around the stair wells, machinery casing, wardroom and galley shall be airtight to the deck above to provide a flame stop.

WIRE MESH BULKHEADS

Bulkheads in the forecastle and forward 'tween deck port and starboard shall consist of galvanized 12 gauge wire mesh in light galvanized channel frames. Bulkheads shall be erected in sections and bolted so that they can be easily removed.

JOINER BULKHEADS

Interior joiner bulkheads other than those indicated to be steel are to be constructed of materials as specified in Section 39 herein.

STACK AND CASING

Stack and casing shall be constructed of 3/16" plate with 2-1/2 x 2 x 3/16" angle stiffeners. The stack shall be arranged so it can be bolted to the top of the casing and the whole stack removed in one piece.

SECTION 12 - HULL FITTINGS

GENERAL

All exterior hull fittings will generally be hot dipped galvanized, except where of non-ferrous material, or where galvanizing is specifically eliminated herein. The finish of miscellaneous hull fittings is to be in accordance with best commercial marine practice. The strength is to be ample for the purpose intended.

MOORING FITTINGS

Four 6" galvanized steel double bitts are to be installed in the forecastle deck. Bitts may be of cast or welded steel of standard commercial patterns or designs similar to Navy Standards indicated on BuShips Dwg. 921985. Four bitts are also to be installed on the inside of the main deck bulwark as indicated on the contract plans. The bitts shall be double and of similar construction to those specified for the forecastle deck except the height from the base to the top plate shall be reduced from 13-1/2" to 6".

Four swallow type closed chocks with 6" x 12" openings constructed of cast or welded steel and galvanized shall be installed on the forecastle deck. The chocks shall be of commercial standard

equivalent to those indicated on BuShips Dwg. No. 921573.

Galvanized cast welded steel chocks of the same opening and the same inside radius as on the chocks in the forecastle, but of the ring type, shall be welded into the bulwark at the locations shown on the contract plan.

FREEING PORTS

A total of 13 freeing ports shall be installed in the main deck bulwark; four port and four starboard in the forward well deck area; one port and starboard aft of the deck house; and three in the area alongside of the midship deck house.

The freeing ports shall be 16" high x 32" long. The ports shall consist of openings burned in the bulwark with the bottom edge 3" above the deck and the forward and after ends burned at a radius. The edges of the plate shall be ground smooth. Three 3/4" diameter vertical bars shall be welded to the insides of the bulwark across each opening spaced equally in the fore and aft direction. In addition to the freeing ports listed, five 3" x 12" drain ports shall be burned into the bulwark with the bottom edge flush with the deck. Two drain ports shall be burned in the port bulwark, one just forward and one just aft of the main deck house; and three burned in the area at

the low point of the sheer on the starboard side.

RAILINGS

All pipe railing is to be welded (screw joints will not be accepted) and galvanized. It may be either fabricated in sections and hot dipped galvanized with field welds zinc sprayed, or fabricated of galvanized pipe with all welds in the top rail ground smooth and given a .010" spray coat of zinc. Welds other than in the top railing need not be ground but must be cleaned as required for the adhesion of the zinc spray. Welds of stanchions to decks or bulwarks need not be sprayed. Railing must be bent to curvature (not welded) at corners and must be braced where required. Rail ends are to be neatly bent toward bulkheads and welded to the same.

Railings around the forecastle deck and the house top shall consist of 1-1/2" pipe stanchions, 1-1/4" top rail, and one course of 1" intermediate railing. The top rail is to be 36" above the deck. Rail stanchions may be of pipe, forgings, or cast steel, at the contractor's option, galvanized, and given a spray coat of .010" zinc at all welds.

Railings shall be fitted on all inclined ladders of single lengths of 1-1/2" pipe, with intermediate pipe stanchions. In order

to allow removal of the ladders the fittings at the bottom of the ladders and at the intermediate stanchions are to be fabricated of cast or welded steel, hot dipped galvanized, and designed so that the pipe itself can be pinned with brass pins to the fittings and the fittings bolted with brass bolts to the ladder proper. The railing at the top is to be pinned with steel plugs inserted into the end of the deck railing or into plugs welded to adjacent structure.

Handrails are to be fitted on one side of the stairway leading from the lower to the main, main to upper, and upper deck to pilot house in the deck house. This railing is to be of 1-1/2" O. D. 14 gauge steel tubing supported by 3/4" round bar bent clips welded to the bottom of the railing and to the adjacent bulkheads. The rail ends are to be neatly capped with all welds ground smooth.

Portable sections of railing are to be fitted at the forward and after ends of the life boats on the upper deck to close off the opening between the end of the fixed railing and the boats proper. The railings shall be portable sections matching the house side railing fitted into pipe sockets welded to the upper deck.

At the top of the stairway in the passageway inside the upper deck house a railing is to be fitted around the ladder opening.

The railing is to consist of 1-1/2" O. D. tubing two rails high with similar square tubing stanchions. The railing is to be neatly welded with all joints ground smooth and welded permanently to the surrounding structure.

The side railing on the upper deck house in the way of the hydrographic platform is to be faired in to the vertical ladder leading down to the hydrographic platform and the opening at the top closed with portable chain guard rail with a snap hook at one end.

Storm rails consisting of 1" galvanized pipe supported on bent round bar clips welded to the houses are to be fitted around the forward and after ends of the starboard side of the main deck house.

Hand railings shall be provided for the engine room ladder and shall be single 1-1/4" steel pipe. Intermediate stanchions required by the ladder length will also be of 1-1/4" steel pipe. Fittings on the ladder are to be arranged by bolting by brass bolts to the supporting structure. Similar single pipe railing with 1-1/4" rails and 1-1/4" stanchions shall be fitted around the edges of the upper level in the engine room.

Grab rails and pipes are to be placed at the heads of all vertical ladders as required for easy access to and from the ladders.

WINDOWS

Windows along the front of the pilot house shall be 24" x 30" clear opening, Kearfott Type K-325. All windows shall be of 1/4" heat treated glass. Window frames, attachments and drip pans are to be of brass or bronze. The two outboard windows are to be moveable type and the balance are to be fixed. The moveable windows shall be fitted with copper drip pans and with drains extending from the drip pans discharging through the upper deck directly below the windows. A Teak sill is to be fitted under the windows in the pilot house to cover the top edge of the sheathing and to make a neat covering around the bottom of the window and the stiffeners between windows.

Windows in the after side of the pilot house and in the pilot house sides port and starboard, and in the sides of the upper deck house are to be fixed, non-opening type of 1/4" polished plate glass of the sizes generally as indicated on the plans. Windows are to be set in heavy neoprene extruded rubber retainor moldings. Corners of the windows are to be rounded sufficiently to allow for the use of this type of molding. Windows shall be carefully and neatly fitted and proved watertight after installation. All sheathing shall be neatly boxed around all windows using stainless steel or aluminum

molding strips as required to provide a neat stop off for the sheathing. Heavy "Monk's cloth", or equal, curtains are to be installed on brass rods in way of deck house windows.

WINDOW WIPER

The center window (fixed window) in the pilot house shall be fitted with a Kearfott pendulum type window wiper with standard throw-out arm as indicated on Kearfott Dwg. No. KS-1385.

PORT LIGHTS

Twelve inch diameter clear glass non-opening type port lights with dead covers shall be installed in the main deck house as indicated on the plans. Dead lights shall be heavy commercial pattern with 3/4" plate glass. The frames may be of bronze bolted to the deck house or may be of cast steel welded in place. Dead covers shall be cast steel hinged and secured with bronze acme thread dog bolts with bronze nuts. Dead covers shall be hinged vertically and brass chain and hooks shall be provided for securing them in the upper position. Heavy "Monk's cloth" curtains on brass rods shall be provided and installed for all ports.

The port light in the watertight door to the hydrographic laboratory on the starboard side of the main deck house, ports in the

aft bulkhead, and ports in the doors in the forecastle head will be of duplicate construction to those specified above. Dead lights in the passage-way door at frame 22-1/2 on the starboard side of the main deck house and in the after door to the upper deck house shall be 10" clear opening in bronze frames without deadcovers.

Port lights in the observation chamber below the water line forward shall have heavy cast steel frames securely welded to the structure with brass bezel rings to hold 1" heat treated plate glass. Ports shall allow a 10" diameter clear opening. All ports are to be fitted with cast steel deadcovers and bronze acme threaded drop bolts and nuts, and with brass chain fasteners for securing the deadcovers in an open position.

Spigots on port lights shall extend 3/8" past the deck house to provide a drip cover. Spigots on port lights in the observation chamber shall be ground flush with the outside of the hull.

PAD EYES

Suitable steel pad eyes are to be welded to the hull on the under side of the overhang at the stern of the vessel in proper position for attaching lifting gear for removing the rudders and

propellers in dry dock. Two inch pipe shall be welded in place through the rudders in proper position to allow bars to be extended through the pipes to be used in lifting rudders.

ZINCS

Zinc plates of 1/2" thickness are to be installed at the stern of the vessel. Two plates each 6" x 12" are to be welded to the shell directly above the rudders and two similar plates each 6" x 12" welded at the after end of the skeg. Not less than 1 square foot of zinc plate 1/2" thick is to be installed on the inside of the sea chest. Zincs and all faying surfaces shall be clean and bright before attachments are made. Plates are to be secured by means of bright, non-corrosive stainless or Monel studs welded to the shell plating.

Zinc shall not be painted, and exposed edges shall be chamfered.

DOCKING PLUGS

Docking plugs of ferrous material shall be fitted in the bottom of the vessel in every compartment. They shall be 1-1/4" IPS fitted flush with the shell and screwed into heavy pads welded on the inside of the hull.

MOORING FAIRLEADS

Two fairleads shall be installed on the forecastle deck to provide a proper lead for mooring lines from the after chocks to the nigger heads on the windlass. Fairleads shall be of standard commercial type with 8" x 3/4" cast steel sheaves with heavy bronze pin mounted on fabricated steel foundations, arranged at a level to give proper leads between the sheaves and the nigger head.

BULWARK GATE

A section of the bulwark 6' long shall be made portable on the starboard side where indicated on the plans. The pipe rail bulwark cap shall be cut in a horizontal plane at a 45° angle to the bulwark and capped both on the bulwark proper and on the gate. The portable section of bulwark shall be fitted with lifting eyes so that it can be lifted by tackle from the cargo boom. The gate shall fit into slotted retainers and be provided with four dogs--two at each end--which can be wedged up tight to prevent the gate rattling when it is in a stowed position.

AWNING STANCHIONS

Three awning stanchions are to be fitted to the main deck at the stern, one at each corner, and one approximately in the

center. The stanchions are to be 7-1/2' high fitted with eyes on the top to take wire rope and are to be constructed of 2-1/2" pipe. Steel plugs for the pipe to fit over are to be selded to the main deck and pads welded to the pipe and to the bulwark to allow them to be secured by two 3/4" brass bolts close to the under side of the cap rail. Stanchions are to be galvanized after fabrication.

ENGINE ROOM LIFTING GEAR

Two "I" beams are to be installed overhead between the webs at frames 25 and 27 directly over the center line of each main engine. The beams are to be 5" x 10# "I" beam sections and shall be welded to the web beams. Each beam shall be fitted with a trolley Yale and Town type "T", or equal, capable of handling a 500 lb. load and fitted with shackle on the under side to take an owner furnished chain hoist.

HARDWARE, GENERAL

All hardware shall be of heavy duty marine type, all bronze construction, similar to that manufactured by "Getty", or equal. All exposed hardware on the inside of the upper deck house, the main deck house, and in the lower deck quarters shall be dull

chrome plate on bronze. All other hardware shall have standard emery bronze finish and be suitable for painting. Screws for securing hardware shall be brass, bronze, or approved material, countersunk, oval head and finished to suit the item secured.

Where necessary to secure positive fastening steel reinforcing plates shall be installed in the way of any hardware items. The pilot house sliding door shall be suspended from a roller track from above and retained by a brass track set on the sill and its extension. Other sliding doors shall be supported on roller sheaves from above and shall have guides consisting of a brass button secured to the bulkhead and engaged in a slot formed by brass retaining strips on the bottoms of the doors. All hinges are to be heavy duty bronze with bronze or white metal finish as required. Exterior doors shall have fast pin butts. All other doors shall have loose pin butts. All butts are to be regular weight nylon bearing type. Hinged wood doors are to be provided with two butts and all other doors with not less than three.

All doors are to be provided with suitable rubber tipped bumpers and hold-back hooks. Means shall be provided for holding sliding doors in both the shut and the open positions.

Door closers shall be installed on the doors leading into the stairway enclosure inside the main deck house. Closures shall be hydraulic type, "Norton", "Yale and Towne", or equal.

All furniture shall be provided with hardware matching the hardware in the surrounding space and shall generally be of the type indicated on the standard furniture plans.

All locks shall be keyed differently. Two complete sets of keys, plus two master keys for each type of lock used, are to be provided. Suitable phenolic or brass identification tags shall be attached to all keys, and to keys delivered to the Owners.

Chromium plated bronze coat and hat hooks are to be installed as follows:

- (a) Two for each berth in all staterooms and in the hospital
- (b) Two in each public and in each private toilet space
- (c) Twelve located where directed in the wardroom
- (d) Two located as directed in each laboratory space, the C.I.C. and the Radio Room.

A hasp shall be installed on the metal hatch covers on the main deck, and galvanized steel flat bar locking bars shall be provided for the wood hatch covers in the well deck forward. Four padlocks shall be furnished to allow these hatches to be secured. Hasps

and padlocks shall also be provided for the refrigerator doors and for the expanded metal doors in the stores spaces on the lower deck at frame 18.

All joiner doors, either metal or wood, shall have mortise locks. All exterior doors are to have rim locks.

SECTION 14 - DECK COVERING

GENERAL

Before laying any deck covering the deck shall be thoroughly clean and dry and free of all rust, grease, oil, paint or other extraneous matter. All deck covering shall be thoroughly cleaned after completion and sealed as recommended by the deck covering manufacturer. Thereafter the decking shall be thoroughly and completely covered to prevent any indentations, marks or wear prior to the delivery of the vessel. Deck covering shall not be laid until after all fastenings for machinery, equipment, furniture, etc., are installed. Deck covering shall not be painted to hide stains or discolorations. Deck covering need not be laid behind built-in berths or other cabinets and furniture having sub-bases.

Deck covering shall be installed in the following spaces:

- (1) Pilot House - rubber matting
- (2) Upper Deck House - outside of toilet spaces - vinyl asbestos
- (3) Upper Deck House in toilet and shower spaces - Dex-O-Tex terrazzo
- (4) Main Deck House, Hydrographic Laboratory, Chemical and Biological Laboratories - wood gratings
- (5) Main Deck House - galley, laundry, toilet and shower spaces - Dex-O-Tex terrazzo.

- (6) Interior of Main Deck House, elsewhere - vinyl asbestos
- (7) Main Deck outside of Forecastle Head and Main Deck House
- wood grating
- (8) Bait and Ship's Refrigerator Spaces - wood grating
- (9) Quarters on the Lower Deck, outside of toilet and shower
spaces - vinyl asbestos
- (10) Quarters in Lower Deck, in toilet and shower spaces
- Dex-O-Tex terrazzo.
- (11) Stores Holds - below lower deck - wood grating.

All other decks shall be bare and painted.

UNDERLAYMENT

All steel decks over which vinyl asbestos tile is to be applied are to first receive an underlayment of an approved type meeting military specifications MIL-D-3135 applied in accordance with the manufacturer's recommendation to a thickness of not less than 1/16" over the high spots of the deck. Should there be ridges, hollows, or other imperfections on the surface after underlayment has been applied which are sufficient to show through or to make an uneven surface for the vinyl asbestos tile a second smoothing coat shall be applied or the underlayment shall be sanded.

Vinyl asbestos tile shall be equal to "Vinyl-Lux" or "Flexichrome". Tiling shall be laid over the Dex-o-Tex underlayment

and secured thereto by means of adhesive as recommended by the manufacturer. Tiling shall be coved all around against bulkheads and built-in furniture with an approved vinyl 'set-on' coving.

Coving may be omitted in built-in locker spaces. Color shall be selected by the Owners from samples submitted by the Contractor. Where tile fits against stanchions, pipes, pipe penetrations, etc., the tile is to be cut about 1/2" clear and a cove worked around the pipes of a laytex mastic deck covering colored to match the cove.

DEX-O-TEX TERRAZZO

Toilet, shower, and galley spaces are to be covered with a Dex-O-Tex terrazzo laid and finished in accordance with the manufacturer's recommendations to a thickness of 1/2". Terrazzo shall be of a color selected by the Owners and shall be sloped to drains and coved up four inches all around. The terrazzo material shall be Dex-O-Tex, or equal, meeting military specification MIL-3134C. The terrazzo shall be sloped to drains and coved up four inches all around. Applicators of underlayment and terrazzo deck covering shall be approved by the manufacturers of the underlayment and terrazzo materials.

STAIR TREADS

Stair treads, and the ladders leading from the lower to the main deck and from the main deck to the upper deck, shall be fitted with "Meleflex" rubber stair treads as manufactured by the Meleflex Co., or equal. Treads shall be not less than 6" in depth, and space between the edges of the treads and the bulkheads of the stairwell at the side and the stair risers shall be filled with a "Dex-O-Tex" material in color to match the stair treads.

PILOT HOUSE DECK COVERING

The entire interior area of the pilot house shall be covered with "Ensolute - Type F" rubber matting 3/16" thick as manufactured by the U. S. Rubber Co.

The matting shall be secured to the decking with an adhesive as recommended by the manufacturer. The matting shall be fitted neatly around bases of the steering stand, binnacles, engine order, telegraph, etc. A neat 1-1/2" set-on cove shall be fitted where matting meets house sides and ends.

RUBBER MATS

Black ribbed rubber matting 24" wide in accordance

with specification MIL-M-1-5562B, shall be fitted on the deck for the full length in front and back of the main switchboard in the engine space.

WOOD GRATINGS

The entire exterior area of the main deck shall be covered with fir gratings made up of 1-5/8" x 3-1/2" fir members with a 1/4" space between them fastened by bronze screws to 1-5/8" x 3-1/2" bearers spaced on about 24" centers. Gratings shall be arranged in sections, each not to exceed 4' x 8', and shall be secured to the deck at four corners of each section by means of bronze nuts fitted over galvanized steel studs welded to the deck. Generally the top members shall run fore and aft and the bearers athwartship. Edges of the top members shall be chamfered about 1/4" to minimize chipping and splintering. Gratings shall be manufactured of good quality Douglas fir. Vertical or slash grain will be accepted, but material shall be free of pitch pockets and knots (other than tight, less than 1/2" in diameter).

Gratings in the Hydrographic and Chemical Labs shall be similarly made in sections and fastened as specified for main deck plating except the top members shall be manufactured of 2" x 2"

stock as indicated in the Contract Plans.

The interior deck surface in the refrigerated spaces shall be covered by gratings manufactured of Douglas fir equal in quality to that specified for the Main Deck, except that both top members and bearers shall be $3/4"$ x $1-1/2"$ and bearers shall be spaced at about 15" centers. The gratings sections in refrigerated spaces need not be fastened to the deck, but are to be a snug fit in sections to prevent them shifting.

Gratings shall be fitted in the hold spaces between frames 17 and $18-1/2$. Gratings shall be constructed of materials and of similar sizes as specified for the main deck gratings except that the under side of the top members shall rest directly on the top of the floors.

Suitable angle and flat bar supports will be fitted all around the edges of the hold spaces to properly support the gratings. One intermediate athwartship support shall be fitted between floors to provide a support every 3'-9" for the gratings. Gratings in the hold need not be secured, but shall be a snug fit to prevent shifting.

Gratings in the holds, laboratories, and refrigerated spaces shall be given two coats of a clear shellac prior to installation.

Main deck gratings shall be given one good coat of hot linseed oil.

ALTERNATE FOR DEX-O-TEX NEOTEX PLATING

As specified in the bidding documents, the contractor is to quote an alternate price for the surfacing of the entire fore-castle deck; the exterior portion of the upper deck, and the bridge wings outside of the pilot house with "Neotex" plating as manufactured by the Dex-O-Tex Co. The "Neotex" plating is to be applied in three coats at 1/4" thickness, consisting of a bond coat, a wearing coat, and tightening coat in an approved light color. The thickness must be at least 1/4" over the high spots in the deck and all hollows in the deck must be filled in so that the top surface is even and flush.

SECTION 15 - GASOLINE STOWAGE

Stowage shall be provided on the forecastle head where indicated for one 50 gallon drum of gasoline. The drum is to be provided by the Owners. Stowage is to be of the quick release type consisting of two angle iron frames set at an angle by which the drum is partially supported, and against which it will be held by means of a bridle of 1/2" galvanized chain secured by a pelican hook and a Manila lashing so that either cutting the lashing or releasing the pelican hook will allow the drum to roll off and overboard.

SECTION 16 - ACCESS

GENERAL

All doors shall be of the type suitable to their particular enclosures and purposes. Watertight doors shall be square and need not be beveled to follow the camber. All other doors need not be beveled if the sheer or camber totals less than 1/4" in the width of the door. Where sheer or camber exceeds 1/4" the doors shall be beveled. Sill heights above the steel deck for the various doors shall be as follows:

1. (a) Pilot House exterior doors - 1-3/4"
(b) Pilot House interior door - none
2. (a) Upper Deck House toilet doors - 6"
(b) Upper Deck House exterior door - 9"
(c) Upper Deck House interior doors other than above - none
3. (a) Main Deck House exterior doors - 12"
(including doors to scuba gear locker, to hydrographic platform, and to companionway to lazarette).
(b) Main Deck House interior doors to galley, washroom and shower spaces, laboratories, stairways, and engine room access - 6"
(c) Main Deck House interior doors other than above - none
4. (a) Forecastle Deck, door to boatswain's stores - none
(b) Forecastle Deck, exterior double doors - 9"

5. (a) Lower Deck - doors to toilet and shower spaces - 6"
- (b) Lower Deck - doors to other spaces - none
- (c) Lower Deck - watertight sliding door, bulkhead 19 - 9".

The distance from the deck covering to the under side of the clear opening of all doors is to be 6'-3". The clear opening of the hinged water tight door leading into the hydrographic laboratory is to be 36". The clear opening of the double doors leading into the forecastle head is to be 48". All other doors are to have a clear opening of 24".

WOOD DOORS

The exterior doors to the pilot house are to be sliding type and are to be constructed of air dried Teak 1-3/4" thick. The doors shall be the panel type with clear 1/4" plate glass light in the upper panel to match insofar as practicable the height of the surrounding windows. The rails shall be tenoned through the stiles and three brass through bolts fitted through the door and plugged at the ends. The door sill shall be of ironbark and the door frame shall be of Teak. The door at the after end of the upper deck house on the center line is to be of similar construction except that it will be hinged and fitted with a dead light in lieu of a window. As an alternate to this the Contractor may furnish a weathertight metal joiner door with rubber

gasketed jambs for this location.

The interior door at the after center line of the pilot house leading down to the interior of the upper deck house is to be of 1-3/8" wood with interior soft wood core and Philippine mahogany exterior facing and trim. The top of the door shall be rabbeted in to a hinged horizontal closure which is to be of similar construction. The frame for both the door and the hinged closure is to be rabbeted of Philippine mahogany.

Doors to the interior staterooms, the C.I.C., the hospital and the radio room in the upper and main deck houses and in the lower deck quarters areas are to be solid panel wood doors with softwood cores and Philippine mahogany veneer both sides, with Philippine mahogany trim. Door thicknesses are to be 1-3/8". Doors are to be sliding or hinged as indicated on the contract plans.

ALTERNATE

The bidding document requires an alternate quotation for replacing wood doors (except those in pilot house) with metal joiner type (as well as replacing wood bulkheads as specified in Section 39). Under this alternate all wood doors outside the pilot house are to be replaced with metal joiner doors of the type specified below.

METAL JOINER DOORS

The interior doors to toilet spaces in the quarters on the upper, main, and lower decks, to the laboratories on the main deck, between the wardroom and galley, the wardroom and the central passageway, and in the stairways leading to the engine room and to the lower and upper decks from the main deck are to be metal joiner type. All metal joiner doors are to be hollow metal flush type. All doors are to be of steel constructed to Navy standards using not less than .02" greater thickness of metal than shown on the Bureau's standard plans. Doors are to be 1-3/8" thick, and doors in the stairways are to be insulated to meet Coast Guard B-15 requirements. All doors must be suitably stiffened internally and constructed for heavy duty service. Butts and plating must be continuously welded against backing strips and must be ground smooth. All metal joiner doors shall have rabbeted metal frames, and where sills are required they shall be of 12 gauge stainless steel. Hinged pass windows between galley and wardroom are to be of similar construction arranged to be held in open position and secured in closed position from the galley side.

HINGED WATERTIGHT DOORS

The doors on the starboard side of the main deck house to the hydrographic laboratory, and on the port side of the main deck leading from the hydrographic platform to the hydrographic laboratory are to be steel watertight type with six dogs, similar to Julius Mott Type 212-A-1.

SLIDING WATERTIGHT DOORS

A horizontal remote operated watertight sliding door, clear opening 24" x 66", shall be installed in bulkhead 20 between the stores space and the crew's quarters. The doors shall be "Walsh & Krentzler", "Continental", or equal, and shall be manually operated from both sides of the door and from a position on the forward side of the main deck house. The operating gear shall consist of hand wheels, cold rolled steel shafting, bronze lubricated bearings, and suitably enclosed gears. Doors shall be installed in complete accordance with U. S. Coast Guard regulations and means of indicating the position of the door shall be fitted at the main deck operating station.

STEEL PLATE DOORS

The door to the boatswain's locker in the forecastle

head shall be of steel plate type constructed of 3/16" plate stiffened with 1-1/2" x 1/4" flat bars. Doors to locker under the hydrographic platform shall be of similar construction.

DUMB-WAITER DOORS

Doors in the sides and after ends of the dumb-waiter at the lower deck and main deck levels shall be approximately 24" x 36" clear opening. The doors shall be of 1/8" plate stiffened by light welded flat bar framework, or may be of metal joiner type. The doors shall be set with the lower edge 36" above the main and lower decks. The door on the forward side of the dumb-waiter at the main deck shall be of 1/4" plate flanged and gasketed all around and secured by four bronze drop bolts.

WIRE MESH DOORS

Doors in the stores spaces on the lower deck and in the forecastle head are to be constructed of light channel framework and wire mesh to match the adjacent bulkheads.

DOORS IN MACHINERY CASINGS

Doors in the machinery casing above the upper deck are to be of special steel angle construction containing louvres for

ventilation supply and exhaust as indicated on the contract plans.

REFRIGERATOR DOORS

Doors to refrigerated spaces are to be standard "Jamison", or equal, wood framed and lined with 20 gauge galvanized steel, rabbetted, gasketed, and fitted with heavy duty galvanized hardware. Insulation shall be not less than 6". Hold-back hooks, bumpers, and interior latch release shall be provided. Doors shall be 30" clear opening in width, with maximum height to suit interior insulation. Portable steel ramps shall be fitted from sill to lower deck in the after sides of the doors.

BOLTED MANHOLES

Bolted manholes are to be provided as required by the U. S. Coast Guard, and the American Bureau of Shipping to all compartments. Manholes to oil and potable water tanks shall be fitted in the sides of the tanks as close to the deck head as possible. All manholes shall be secured with bronze studs and nuts. In all cases studs shall be not less than 3/4" in diameter and shall be tapped into heavy rings welded to the tank or the deck plating. Gasket material for manholes is to be oil tight or water tight to suit the location.

Manholes on tank sides shall be fitted with two round bar lifting handles. Manholes to the forward ballast tank, after peak oil tank, and flume tank shall be located in the deck. Manholes shall be 15" x 23" clear opening. Manholes in deck under refrigerated spaces are to be covered with removeable wood cork insulated plugs. Manhole in flume tank shall be recessed with a flush cover fitted over the recess. Cover shall be steel plate type banded on the edges with 2" brass flatbars neatly mitered at the corner and secured to the plate with flush brass cap screws. The space between the bars on the top of the cover shall be finished with deck covering matching the surroundings. One small flush ring lifting handle will be fitted. The hatch will be held in position by its own weight, and when in position the entire surface of the hatch and the surrounding floor covering shall be entirely flush. Non-tight covers similar to above shall be fitted to openings over recesses over water soil tanks.

ENGINE ROOM ESCAPE HATCH

The escape hatch to the main deck in the wardroom is 24" x 24" with cover similar to that specified above over the manhole to the flume tank.

HATCH TO FORE PEAK

The hatch to the fore peak shall be 24" in diameter with a 24" steel plate coaming and with a hinged watertight cover similar to Julius Mock Fig. #311A-1.

HATCH TO LAZARET

A hatch approximately 3-1/2' x 4' is to be fitted in the main deck aft for access to the lazaret. The hatch coaming is to be 3" high and the cover is to be similar to Julius Mock Fig. No. 418-A-P.

ACCESS HATCH TO STORES SPACE

A hatch 30" x 72" shall be fitted in the well deck forward on the port side for access to the forward stores space. Hatch shall have a 24" steel coaming and a steel cover hinged at the forward end with a brace to hold it in the open position. Cover shall be secured by bronze dog bolts and be fitted with an 18" diameter quick acting escape scuttle operated from below only. Hatch and cover shall be good for 5 lbs. pressure and be as manufactured by Julius Mock & Sons, Inc.

MAIN STORES HATCHES

The hatch to the stores spaces on the main and lower decks at frame 18 are to have clear openings 6' x 6'. The weather deck hatch is to have 24" coaming constructed generally as indicated on the contract plans. The hatch is to be complete with steel strong back and wood hatch covers fitted with galvanized flush lifting handles, 2-3/8" galvanized steel tarpaulin battens, and hardwood wedges. The hatch on the lower deck is to be flush with hatch boards similar to those specified for the main deck.

The hatch at frame 12 to the bait stowage space is to have 5' x 5' clear opening and steel hatch coaming 32" high constructed approximately as indicated in the contract plans. The hatch is to be insulated as specified in Section 39 and fitted with insulated plug covers in two sections, each approximately 2-1/2' x 5' with rabbetted edges where they connect, and with galvanized flush lifting handles. The covers are to be made of 3/4" marine plywood top and bottom with Douglas fir framing and 4" net cork insulation applied in hot asphalt. The hatch is to be provided with tarpaulins, battens, wedges, etc., as required.

VERTICAL LADDERS

Vertical ladders are to be installed where indicated on the contract plans, and ladders or climbing rungs are to be installed to provide access to all tank spaces as required. Vertical ladders exposed to the weather are to be constructed of 1-1/2" pipe stringers and 5/8" bar rungs with stringers bent over at the ends and bolted to steel plugs welded to the house side at bottom and either bolted to the house side at the top or extended up to connect to the deck railing. Exterior ladders are to be galvanized after fabrication. Inside ladders may be of similar construction ungalvanized, or may be constructed of 2-1/2" x 3/8" flat bar stringers with 5/8" round bar rungs. In tanks ladders may be formed of 5/8" diameter round bar rungs welded between stiffener flanges. Ladder and rung widths are to be not less than 18". Vertical ladder in the hydrographic laboratory shall be 12" wide with 5" flat bar stringer and 3/16" flanged plate treads, made easily portable for access to the locker space back of the ladder. Hand rails are to be fitted both sides of the ladder above the platform level.

RUNGS

Climbing rungs welded to the adjacent structure are to be provided as required in the machinery space for access to machinery valves, operating gear, etc., where such equipment can not be operated or serviced from floor plates, decks, or other ladders. Round bar climbing rungs are to be bent to a "j" shape and are to

be welded to masts and staffs as required for access and servicing.

INCLINED LADDERS

Exterior inclined ladders above the main deck are to be built of 6" x 3/8" flat bar stringers with flanged checkered plate treads. The ladders shall be galvanized after fabrication and shall be bolted with brass bolts to clips on the top and bottom. The interior inclined ladders shall be of similar construction but need not be galvanized.

STAIRWAYS

The central stairwell between the lower and upper decks is to be constructed of 3/16" plates flanged so that one plate forms one tread and one riser. Treads and risers shall be welded continuously to each other and to surrounding structure to form a tight enclosure.

EMBARKATION LADDER

One Coast Guard approved embarkation ladder is to be installed as directed by the Coast Guard at the life boat embarkation station.

PORTABLE DIVER'S PLATFORM & LADDER

The Contractor shall furnish and install one portable diver's ladder and platform to be located in the opening of the main deck bulwark when the bulwark gate is removed. The ladder shall be constructed of 1-1/2" O.D. x 25" aluminum tubing extending from the 10'-6" waterline up to 3' above the main deck level, being curved inboard and back down to the deck 18" in from the shell. Ladder rungs will extend from the bottom to the main deck level and shall be of 3/4" IPS aluminum pipe. Horizontal braces shall be fitted about 3-1/2" above the main deck level between outer and inner vertical members, and duplicate aluminum tubing shall be welded to the braces designed to fit down over steel plugs welded to the deck with their tops flush with the top of the gratings. Tubes and plugs shall be drilled and 1/2" stainless steel bolts provided to securely bolt the ladders to the plugs. At the bottom of the diver's platform aluminum hinge blades shall be welded designed to secure through 5/8" stainless steel pins a 24" x 36" diver's platform. The platform shall be supported by a 1/4" stainless steel chain led from the outboard edges of the platform up to the main vertical pipe members. Portable 1" aluminum pipe stanchions shall be fitted at the corners of the platform extending 3' high bent at the top and led back to the vertical

members of the ladder. Stanchions shall fit over plugs welded to the platform and to the sides of the vertical members, and be secured by bolting with stainless steel bolts. The bottom platform shall be constructed of 1-1/2" O.D. tubing framework with a 12 gauge aluminum expanded metal bottom. The expanded metal shall be welded to the tubing all around, care being taken that no sharp corners or edges are left to cut divers' suits. Clips shall be provided in the overhead of the forecastle space for stowing the ladder when not in use.

ENGINE ROOM FLOOR PLATES & LADDERS

Floor plates in the engine room shall be 8 lb. checkered type "Allen Wood Super Diamond Pattern", or equal, installed generally as indicated on the contract plan machinery arrangement. Floor plating is to be supported on 2" x 3/16" angle framework welded in place, except where required to be removeable for machinery repairs where it shall be bolted. Floor plates shall be secured by 3/8" brass counter-sunk flat head screws, and be provided with portable hand hold plates over valves, operating gear, etc.

Engine room ladders shall be constructed of 6" x 3/8" flat bar stringers with 3/16" flanged checkered plate tread and shall be

located to provide access from various levels and to the deck above
generally as indicated on the contract plans.

SECTION 17 - MASTS, BOOMS & STAFFS

FOREMAST

The foremast shall be free standing located at frame 15 with a height of 36'-0" from the main deck to the truck. The mast shall extend through the main deck and rest on a double plate on the lower deck and be welded to the lower deck, bulkhead 15 and the main deck. Scantlings of the masts shall be as required by the U. S. Coast Guard and the American Bureau of Shipping to take the stresses induced when handling 4000 lb. loads either with a single boom or by burtoning with two booms. Masts shall be 24" internal diameter at the main deck and shall be tapered to 18" internal diameter at the truck. The plating shall be not less than 7/16" thick for the bottom 20 ft. and not less than 3/8" thick above. The truck shall be of welded steel plate construction to take the topmast and fittings for the boom topping lifts, the forestay and triatic stay, and with pads located port and starboard for a boatswain's chair. Topmast shall be the length shown on the plans and shall be 6" standard steel pipe. The topmast truck shall be of similarly welded construction fitted with pads port and starboard for a boatswain's chair and for

halyards. Pads shall be installed on the topmast as required for antenna leads. The foremast truck plate shall be not less than 30" athwartship width and 24" in fore and aft length at the centerline of the mast. Four pipe rails of 1" galvanized steel pipe shall be welded to the truck and a circular 1" pipe rail fitted to the stanchions 3' above the truck to provide protection for servicing equipment. One 2" pipe yard arm shall be secured to the forward side of the mast where indicated fitted with pads to take halyard blocks for hoisting fishing lights.

Boom steps shall be fitted to the foremast located 6' above the deck set at an angle approximately 45° each side of the centerline. Platforms for booms and the boom steps shall be of welded plate construction to take cast or welded sockets for the boom heel pins. The sockets shall be bronze bushed and Alemite lubricated. Topping lift fittings at the truck shall be swivel type and also be bronze bushed with Alemite lubricated fittings.

One 6" x 12.5 lb. "I" beam shall be installed between the foremast and forecastle head on the centerline of the ship and fitted with a padeye on the under side to take an Owner furnished block for lowering bait boxes, etc., into the space below.

FOREMAST BOOMS

Two cargo booms each 35' long shall be fitted in the foremast as shown. The booms shall be designed to handle a maximum load of two tons operating alone or by burtoning. Booms shall be standard type as approved by the American Bureau of Shipping and may be of pipe or tapered steel circular welded sections of plate but shall have an equivalent section of not less than 6" standard schedule 40 steel pipe at the center.

The heel pin fitting shall be of the type that will also take the cargo fall heel block. Pads shall be fitted in the end of the booms as required for cargo falls, topping lift, and vang leads. Boom supports consisting of welded steel plates with a circular retaining section and hinged semi-circular clamps for securing the booms shall be fitted on the front of the deck house to take the cargo booms in a horizontal position.

JACKSTAFF

A Jackstaff consisting of 2" standard galvanized steel pipe extending 8' above the deck shall be fitted at the bow. The Jackstaff shall be fitted with a steel plated truck of sufficient size to take anchor light and to provide a padeye for a bronze halyard.

Masts shall fit over a steel pin or into a pipe type socket and arranged to be held in place by a 1/2" bronze toggle bolt. Small welded steel cleats shall be fitted at the base of the staff to take the halyard leads.

QUADRUPOD

A quadrupod mast shall be constructed and installed by the Contractor on the upper deck house aft. Arrangement and construction shall be generally as indicated on the contract plans. The quadrupod shall be fitted with three "A" frames, one port and one starboard, and one leading astern to take leads from the plankton winch and bathythermograph winches. All hinge pins are to be steel, bronze bushed, and supporting structure of the upper deck house shall be suitably reinforced to take the mast loads.

SECTION 18 - RIGGING & CANVAS

SHROUDS & STAYS

The foremast shall be fitted with a 3/4" diameter forestay and a 3/4" triatic stay leading to the quadrupod. Wire rope shall be 6 x 7 plow steel galvanized with poured open sockets. Each stay shall have one forged steel open turnbuckle. Turnbuckles shall have copper bonding. Forestay is to have a galvanized deadeye seized to it to take the forward fishing light where shown on the contract plans. Stays are to be broken with not less than 5 insulators.

FOREMAST RUNNING RIGGING

Cargo booms shall be rigged with four part 7/16" wire rope topping lifts and four part 3-1/2" circumference Manila cargo falls. The topping lifts shall be improved plow steel wire rope 6 x 37 construction. Each cargo boom shall be fitted with two vang's consisting of a single 5/8" 6 x 7 plow steel galvanized pendants with open poured sockets and shackles at each end and with four part 2-3/4" circumference Manila tackle.

Manila blocks shall be Boston Lockport, or equal, of the heavy, wide mortised wood shell type. The cargo fall and topping

lift blocks shall have not less than 8" diameter sheaves and shall be Boston Lockport steel construction, or equal. All sheave bushings shall be graphite bronze and all metal parts of all blocks shall be galvanized. Not less than 8 padeyes and 8 12" cleats shall be installed, four port and four starboard, to take the vang falls located as directed.

Cargo fall lead blocks at the keel of the boom shall be single blocks secured to a swivel at the bottom heel. Cargo falls shall be fitted on the outboard end to a Boston Lockport, Seattle pattern type cargo hook.

For servicing trawl nets and other fishing gear a galvanized steel graphite bronze bushed single block shall be shackled to a 3/4" galvanized steel chain pendant about 8'-0" long with the other end of the pendant shackled to a pad on the foremast at the truck level. Block shall be for 2-3/4" circumference Manila. Manila rope shall be furnished and rigged by the Owners.

MISCELLANEOUS

Two halyard blocks shall be provided for the main topmast, the triatic stay, and for the Jackstaff. Three halyard blocks shall be

provided for the yardarm and forestay. The blocks shall be all bronze Boston Lockport, or equal, provided with 3/8" cotton halyard lines. Cleats shall be installed to take the lower end of the halyards. In addition, a pair of wide mortised wood shell blocks with necessary fittings shall be provided for each topmast and fitted with 2" circumference Manila rope for boatswain's chairs and antennae lifts. One set of tackle will be required for each mast. Cleats shall be provided at the bottom ends of the foremast and mainmast as required to take the boatswain's chair and antennae lifts.

QUADRUPOD RIGGING

Blocks and leads from plankton and bathythermograph winches to the ends of the quadrupod "A" frames will be furnished and installed by the Owners.

Wire rope "A" frame topping lifts shall be provided and installed by the Contractor as indicated in the contract plans. Tackle shall be Contractor furnished and shall be led to hand topping winches specified in Section 20 herein.

Preventer stays indicated for all "A" frames shall be 1/4" bronze wire rope with bronze fittings. Bottom fitting shall be

of tackle shall be provided; normally used for the port and starboard frames. One set shall be shifted manually when topping the after frame.

Preventer stays indicated for all "A" frames shall be 1/4" bronze wire rope with bronze fittings. Bottom fitting shall be a shackle and turnbuckle, top end a standard hook.

AWNING

3/8" galvanized wire rope shall be fitted from the after end of the house through the eyes of the awning stanchions specified in Section 12. An additional centerline spreader wire shall be installed. Wire shall be fitted with thimbles, wire seizing turnbuckles, etc. A 3/8" pipe jack rod shall be served by welded clips to the after side of the deck house. The entire stern area is to be covered with a #4 awning complete with chafing pads, brass grommets, and lashings.

SECTION 19 - PAINTING & CEMENTING

GENERAL

Unless otherwise specified, all paint and finishing materials shall be furnished by the manufacturer ready to use, and must not be altered or changed in any way. Paints must be applied in accordance with manufacturer's directions; and in the case of the "Dimetcote" specified for the surface of the hull it must be applied under the specific direction and inspection of an authorized representative of the manufacturer. Paint may be sprayed or brushed as permitted and approved by the manufacturers.

When more than one coat is specified, subsequent coats shall not be applied until the preceeding coat has become properly dry and hard. Before application of any following coat the bare spots in the preceeding coats shall be touched up. Varnish work shall be sanded and rubbed after each coat.

No finish painting shall be done in compartments or tanks required to be tested until after completion of such testing.

Before painting galvanized work which is not adequately weathered the surfaces shall be cleaned with ammonia and vinegar or a copper acetate solution in order to secure a firm bonding of the paint.

All fixtures, adjacent surfaces, etc., shall be properly protected during painting and upon completion of the work all paint and varnish shall be removed from glass, plumbing fixtures, deck covering, etc. Where the term 'surface' is used it is intended to cover all surfaces, including pipes, cables, vent ducts, etc.

All enamels are to be flowed on and not brushed on.

In the machinery space the last coat of paint is not to be applied until after completion of the dock trials.

All colors of finish paints must be in accordance with the Owners' approval. Samples of all colors are to be submitted for approval prior to procuring materials.

SURFACE PREPARATION

All steel work in the vessel shall be allowed to weather in the open and painting shall be held off as long as possible in order to get the maximum amount of weathering. Prior to painting all steel shall be scraped and carefully wire brushed to remove mill scale; all grease shall be removed by proper solvents, and the surface shall be dry and free from dirt prior to painting.

Where "Dimetecote" is specified to be applied, the steel surface shall be dry sandblasted to bare metal in accordance with

manufacturer's specifications.

HULL, EXTERIOR

The exterior portion of the hull, including rudders from the keel up to the top of the bulwarks, the forecastle whale back, and the entire port side of the deck house from the main deck to the upper deck level, and the entire interior of the bulwark above the main deck, shall be given one application of "Dimetecote" #3 applied to a thickness of 3 mils. After proper curing the "Dimetecote" is to be given one prime coat of "Dimetecote" #86, followed by two coats of "Dimetecote" #33. The #33 material shall be of dark green color below the boot topping line and white above the boot topping line except for the bulwark rail cap, the whale back on the forecastle head, and the inside of the bulwark, which shall be black. Following the application of the #33 the area below the boot topping line shall be given one coat of "Amercote" #67, anti-fouling. The painting of the exterior of the hull shall be left as long as possible during construction and may not be done until all welding has been completed in the hull, until all equipment has been mounted, and until all work has been completed which might damage the paint. During the application keel blocks, bilge blocks and other supports shall be

shifted so that the entire surface is sandblasted and painted with no bare spots.

The exterior surface of the main deck shall be painted with one coat of "Eureka Fluid Film", Odorless, Grade "B", White, #11 to a minimum film thickness of .065". Painting must not be done until the gratings are ready to be put aboard and the gratings must be put in place directly after the surface is covered and means taken to prevent any damage to the surface by walking, etc.

The entire exterior surface of the upper deck house and pilot house and the aft end of the forecastle and forecastle deck are to receive two prime coats of red lead paint meeting Federal Specification TT-P-86A, Type 2, allowed to dry thoroughly between coats. Following the priming coats the vertical surfaces shall be given two finish coats of an approved exterior marine enamel, Dupont "DuLux", or equal. The deck surfaces of the main deck house, upper deck house, pilot house, and forecastle deck shall receive one coat of haze gray deck paint, Dupont, American Marine Co., or equal. Masts, stack and casing, winch operator's enclosure, and other deck erections and fittings shall receive two coats of red lead

and two coats of finished enamel in colors selected by the Owners.

All standing rigging shall receive one coat of "Eureka Fluid Film", Grade WR Aluminum #12. Topping lift and wire rope anchor cable shall be treated with one coat of grade WR liquid wire rope preservative prior to installation.

HULL, INTERIOR - PRIME COATS

The following spaces are to receive one prime coat of a metallic zinc coating equal to "Dry Galv" meeting Military Specification MIL-P-21035, to a film thickness of .025".

- (a) All interior surfaces between lower and main deck, aft of frame 28.
- (b) All interior surfaces between lower and main decks between frames 17 and 24 and 24 to 28 which are not covered with deck covering, insulation or sheathing.
- (c) Shell, bulkheads and deck head above the floor line in the hold - frames 17 - 18-1/2.
- (d) Shell, bulkheads and deck head outside of chain locker below main deck and forward of frame 7.
- (e) The entire interior of the forecastle head.
- (f) Interior steel surfaces of house sides, bulkheads and deck head in main deck house, upper deck house, pilot house, stack and casing which are not covered with insulation, linings or sheathing.

Other interior spaces are either oil tanks not requiring painting

Bituminous Composition Co. of Philadelphia, Pennsylvania. The material shall contain no volatile ingredients, shall not burn or explode, and shall not be soluble in petroleum products. Care must be taken in the application of this material to insure that adequate ventilation is provided for the compartments so that each coat is thoroughly and completely dry prior to the application of the following coat and prior to delivery.

Space below the floor boards in the dry holds from frames 17 to 18-1/2 shall be completely cleaned and given one coat to a .065" film thickness of "Eureka Fluid Film", Odorless, Grade "B", White, #11.

The interiors of oil tanks are to be cleaned of scale and rust and wiped down with a coating of diesel oil prior to filling.

The interior of the ballast tank below the lower deck forward shall be given one coat of "Eureka Fluid Film", Grade "B" Natural. The entire interior of the flume stabilization tank is to be coated with "Eureka Fluid Film", Grade "B", Aluminum #12 to a .065" film thickness. The void spaces in the flume tank area are to be coated with "Eureka Fluid Film, Grade "B" , Natural.

The interior of the fresh water tank is to be coated with one coat of "Eureka Fluid Film, Grade WT to a film thickness of .050".

machinery space shall be given two coats of light gray machinery heat and oil resistant machinery enamel. Valve hand wheels, operating levers, etc., in the engine room shall be painted with special colors as directed. The deck machinery shall receive not less than two coats of good quality black enamel. Furniture and metal joiner doors shall have baked enamel finish.

WOOD TRIM

All window trim, all wood doors, door stiles, and door frames shall be sanded down, filled, and given not less than two finish coats of Dupont Spar Varnish, Code RAK-147.

CEMENT

Cement shall be installed in the bottom of the forward observation chamber, and elsewhere as indicated on the contract plans, as required to provide proper drainage to bilge sections. Prior to supplying the cement surfaces shall be free from all rust, grease or other foreign material. Top surfaces will be given a trowelling smooth coat and care shall be taken to slope the surfaces as required for drainage. Cement shall have a density of 150 lbs. per cubic foot.

ALTERNATE FOR ADDITIONAL "DIMETCOTE"

The Contractor is required in the bidding documents to provide a separate price for the use of "Dimetcote" on the exterior surfaces of the deck houses not now specified to be so coated. Surfaces shall be sandblasted, given one coat of "Dimetcote" #3, one coat of Primer #86, and two coats of "Dimetcote" #33 in approved colors. Details of application as specified herein for the "Dimetcote" on the hull. The after side of the forecastle bulkhead shall be included. The top of the pilot house but not the top of the upper deck is to be included.

SECTION 20 - WINCHES

HYDROGRAPHIC & PLANKTON WINCHES

The Owners will furnish and the Contractor will install two oceanographic winches; one for hydrographic and one for plankton service, located on the upper deck as indicated in the contract plans. The winches will be "Markey", Type DYSH-3. The winches will be duplicate, each having a capacity of 30,000 ft. of 3/16 7 x 7 sounding wire, but the plankton winch will be mounted on a swivel base that will allow it to rotate 180°. The Owners will furnish to the Contractor a 40 horsepower electric hydraulic package complete with tank and heat exchangers, to be installed in the engine room and connected by hydraulic lines to both winches. The hydrographic winch will be controlled by an operator located in the winch control house. The plankton winch is to be so arranged with its hydraulic controls that it may be operated both at the upper deck level and at the platform level as outlined on the contract plans.

The controls of the hydrographic winch are to be located in the winch control house. The Contractor is to relocate the clutch and brake levers from the winch by extending the shafting and moving the levers and bearings over on a suitable foundation inside the control house.

In addition to the winches, the Owners will furnish the wire for installation on the winch drums. Wire will be furnished on conventional wire rope reels. The Contractor is to receive the wire and to coil it on the winch drums.

BATHY THERMOGRAPH WINCHES

The Owners will furnish two Navy type self-contained bathythermograph winches for installation on the upper deck aft as indicated in the contract plans. The Contractor shall mount these winches on suitable foundations and connect them up in operating condition.

TRAWL WINCH

The Contractor is to furnish and install one heavy duty trawl winch "New England Trawler Co." or "Tacoma Boatbuilding Co." Northern Model 2-100-12 ETW, or equal. Trawl winches shall be ruggedly designed and with all parts capable of handling a breaking strength of 3/4" 6 x 19 plow steel wire rope. The winch shall consist of two drums mounted on a common horizontal shaft with jaw clutches to each drum. Lined brakes and pawls shall also be fitted on each drum. Each drum shall have a capacity of 6000 ft. of 3/4" wire rope with 3" clear flange when filled. The winch shall be powered by an

electrical heavy duty 75 HP, 2-speed reversible marine motor with industrial type reduced voltage starter and remote switch. The winch shall have two double gypsies, one at each end of the shafts, and shall be fitted with two hand operated level winders. The winch shall be designed for a line pull at the mean drum layer of 14,000 lbs. at a line speed on the mean layer of 160, 50 and 30 feet per minute. The winch manufacturer must be experienced in the design and construction of heavy duty winches for trawling service. Electrical starting controls shall be located below decks in the hold stores space and shall be enclosed with suitable wire mesh enclosure to protect it from damage. The local control station shall be located adjacent to the winch.

The Owner will furnish the trawl cable and the Contractor shall reel the cable aboard the drums on the vessel.

TOPPING LIFT WINCHES

The Contractor shall furnish and install two topping lift winches, each similar and equal to "Marine Construction & Design Co." Model W-0800. The winches shall have a drum capacity of 550 ft. of 1/2" rope and be capable of a line pull of the bare drum of 2800 lbs., and of full drum of 1600 lbs. when provided with

hydraulic oil at a pressure of 1000 lbs. The line speed of the bare drums shall be 86' per minute, and the full drum at 148' per minute. The winches shall be mounted on suitable foundations on the forecastle head and fitted with Contractor furnished wire rope as specified in Section 18 herein.

The Contractor shall also provide and install one packaged hydraulic unit for operation of the topping lift winches similar to "Marine Construction & Design Co. Dwg. A-30890". The hydraulic package shall consist of a 20 hp electric motor mounted on a 50 gallon hydraulic tank with one 8 gallon/minute pump on the shaft on one end of the motor, and two 16 gallon/minute pumps on extended shafts on the other end of the motor. One 16 gallon/minute pump shall be used for the topping lift winches and shall be connected with all necessary controls for suitable operation of the winches. The openings in the other pumps shall be blanked for future installation by the Owners of a hydraulic system for the operation of a power block and cargo falls winches. The hydraulic package shall be located under the forecastle head where indicated on the contract plans.

HYDROGRAPHIC WINCH CONTROL HOUSE

The Contractor shall construct a house for protection of the hydrographic winch operator on the upper deck where indicated in the contract plans. The house shall be constructed of 3/16" steel plates suitably framed, completely open on the after end, and with 24" x 30" 1/4" heat treated plate glass fixed windows set in extruded rubber frames on the forward end and starboard side; one moveable Kearfott type K-325 window on the port side. The house shall be actually set over the extended brake and clutch control shafts of the hydrographic winch so that the operator in the house can operate the brake and clutch levers. Hydraulic controls shall also be mounted inside the house in a position so that the winch operator can operate the controls and still can see the lead of the wire over the hydrographic davit.

LONGLINE HAULER

The Owners will furnish one "IZUI" No. 6 long line hauler for installation by the Contractor. Foundation will consist of a circular plate set flush with the top of the deck gratings on welded clips and drilled for holding down bolts of the machine base. A bulwark roller assembly is also furnished with the machine and is to be mounted in the bulwark in holes drilled in the bulwark cap.

The Contractor shall furnish the drive for the long line hauler consisting of one 10 horsepower electric motor, 440 volt 3-phase 60 cycle with across the line starter. Motor shall be mounted on the shell in the forecastle head on an adjustable base and drive through V-belts a shafting system leading to the hauler. Shafting shall be 1-3/4" cold rolled, mounted in cast iron, bronze bushed, alemite lubricated pillow blocks. Motor shall turn 1800 rpm and shafting 300 rpm. Shaft bearings on the well deck shall be mounted on steel pedestal bolted in turn to foundation pads flush with the top of the deck gratings to allow the deck to be cleared when the long line hauler is not used.

Vee-belt sheave on the shaft end under the motor shall be mounted on a small section of shafting with a coupling on the after end and self-aligning ball bearing pillow blocks each side of the sheave with one thrust collar. A pipe nipple and cap type stuffing box with large clearances shall be fitted in the shaft where it penetrates the forecastle bulkhead.

QUADRUPOD TOPPING WINCHES

Three 5 ton "Beebe" or equal hand wire rope hoists complete with brakes and pawls with Contractor furnished wire rope

shall be furnished and installed on the Quadrapod where indicated to serve as topping winches for the three "A" frames.

ALTERNATE -- TRAWL WINCH

The bidding documents require the Contractor to quote a separate price for the deletion of the trawl winch. Under this alternate the Contractor is to provide switchboard bussing and cable leads as required, but is to dead end the capable leads in a junction box under the main deck in the forward hold space.

ALTERNATE -- TOPPING WINCHES

The bidding documents require the Contractor to quote a separate price for the deletion of the topping lift winches and associated hydraulic package. Under this alternate the Contractor is to run the cable for the hydraulic package to the forecastle and dead end it in a junction box under the forecastle head. In lieu of the wire rope topping lifts specified, the Contractor is to provide 5 part, 3-1/2" Manila tackle for each boom, complete with galvanized wood shell blocks, deck pads and snatch blocks for leads to the anchor windlass gypsies and cleats for securing the topping lift lines.

SECTION 21 - HYDRAULIC SYSTEMS

GENERAL

The Contractor shall install hydraulic systems for the steering gear, hydrographic winches and davit and for the topping lift winches as required for satisfactory operation of these units of equipment. All hydraulic piping shall be steel tubing, and all fittings, valves and materials shall be wholly in accordance with the requirements of the U. S. Coast Guard. All tubing in the hydraulic systems shall be pickled and the systems cleaned by circulating hot oil as specified for the lubricating oil system in Section 45.

STEERING GEAR HYDRAULIC SYSTEM

The arrangement and details of the hydraulic system for the steering gear shall be in accordance with the requirements of the steering gear manufacturer.

HYDRAULIC SYSTEM FOR HYDROGRAPHIC WINCHES & DAVIT

The general arrangement of the hydraulic control system for the hydrographic winches and davit is indicated on the contract plans.

HYDRAULIC SYSTEM FOR TOPPING WINCH

The Contractor shall furnish the power package specified in Section 20 and connect up a hydraulic system to the topping winches as required for full reversing operation.

SECTION 22 - STEERING

RUDDERS

Twin rudders shall be fitted at the after end of the vessel at the location and of the general type of construction as indicated in the contract plans. The rudders are to be of the balanced type, streamline section, built up of plates and structural shapes. The rudder stock is to be a tapered fit and keyed to the rudder casting proper. Removeable plates are to be provided as required for access to the bottom of the stock, removal keys, etc. The rudders are to be fitted with pipe plugs for filling and draining, and with pipes through the body of the rudder to allow bars to be inserted for removal.

RUDDER STOCK CARRIER BEARINGS AND QUADRANTS

The rudder stock shall be of forged steel to ABS requirements. The carrier bearings shall be the type clamped to a recess in the stock and outfitted on a grooved bronze floating ring. The rudder stock shall be bronze bushed in the way of the bearings and shall be of the Micarda type. The top of the stock shall be drilled and fitted to take an eye bolt and a removeable flish plate shall be fitted in the deck over the top of each stock for lifting. A stuffing box

shall be installed at the bearing.

The rudder stock shall be keyed to cast steel quadrants in order to take the pull from the steering ram. The quadrants shall be designed for strength in excess of the rudder stock.

STEERING SYSTEM

An electro hydraulic steering system shall be installed similar or equal to that manufactured by the Sperry-Rand Corporation. The steering system shall consist of a duplex gyro pilot stand with pump transfer switch and indicating lights located in the pilot house, one non-follow up steering controller located at the starboard bridge wing, one main electric driven hydraulic pump unit, one auxiliary electric driven hydraulic pump unit, rudder angle transmitter and two rudder angle indicators, one located in the pilot house and one on the starboard bridge wing. The entire system shall be complete in full accordance with the requirements of the U. S. Coast Guard and the American Bureau of Shipping, and shall have sufficient capacity to move both rudders from hard over to hard over (70°) in not more than 20 seconds when the vessel is going ahead at the speed of 13.5 knots. Hydraulic pressure during any part of the steering cycle shall not exceed a peak of 1000 lbs.

The steering stand and pilot house shall be the gyro pilot type connected to the gyro compass system to permit manual or automatic steering on a pre-set course, and/or non follow-up steering from the starboard bridge wing. The steering control on the main stand shall be full follow-up type.

The hydraulic control system shall be so arranged that when power to the steering system is shut off the rudder shall be hydraulically locked in position.

SECTION 23 - SPECIAL FISHING & OCEANOGRAPHIC EQUIPMENT

HYDROGRAPHIC DAVIT & PLATFORM

The Contractor is to provide and install a davit and hydrographic platform on the port side of the vessel as indicated on the contract plans, complete and in operating condition. Hydrographic lead block support on the davit shall be hydraulically retracted as shown.

GALLOWS FRAMES

Two hinged gallows frames shall be installed against the bulwark on the starboard side. The gallows frames shall be constructed generally as shown on the contract plan. Where details are not indicated they are to be similar to "New England Trawler Equipment Co. Standards". Both gallows frames shall have fairleads in their legs set at a suitable angle to obtain correct leads to the trawling bollards. Gallows frames will be provided with means as shown to swing them inboard clear of the rail when docking the ship. The gallows frames shall be sufficiently strong and shall be adequately supported to take the breaking strength of 3/4" wire rope. The gallows frames shall be furnished complete with two "New England Trawler" gallows blocks, Catalog #941.

TRAWLING BOLLARDS

Three single steel bollards, "New England Trawler" Catalog #946, or equal, are to be installed on the forward well deck as indicated on the contract plans. The heights of the bollards are to be to suit the leads from the trawl winch to the gallows frames.

DAVIT AT BULWARK GATE

One steel pipe davit, galvanized after assembly, shall be installed just aft of the bulwark gate where shown on the plans for lifting gear and heavy fish aboard through the gate. Davit shall have a capacity of 1000 lbs. and be fitted with pads and shackles at the davit head to take Owner furnished Manila lifting and swinging tackle. Davit shall be supported in a bronze bushed pipe socket welded to the deck and bulwark structure.

SECTION 24 - SHIP CONTROL SPACES

PILOT HOUSE

The spaces port and starboard of the centerline companionway leading down to the upper deck house in the after end of the pilot house shall be fitted up as shelves. The shelves shall be formed of 3/8" waterproof plywood laid on top of the upper deck house top and covered with 1/8" green linoleum. Front edges, connections to the centerline door opening and around the back shall be trimmed in teak. The entire top surface shall be parallel to the base line and shall not follow the camber. Fir blocking shall be fitted under the plywood shelf for this purpose. The front edge shall be suitably trimmed in teak to cover the joint between the steel and the plywood. On the port side an instrument and chart locker with two interior adjustable fir shelves, and with all exterior surfaces of teak, shall be installed of size and in the location indicated.

A teak shelf shall be installed between the gyro pilot's stand and the window in order to take a shelf-type magnetic compass. The compass shall be "W. O. White, Inc." flush mounted, widering 8" Constellation, complete with compensating magnets, etc.

In the space starboard of the gyro pilot stand and the

magnetic compass shelf is to be fitted an engine control stand. The stand shall have a teak top to be fitted flush with the front bulkhead of the pilot house and the sides and ends shall be of the same material as used for the pilot house linings. The front shall be secured with screws to be removeable. On the top surface of the control stand the engine controls and associated gauges are to be neatly mounted. All engine controls and the protruding metal surfaces of the instruments are to be chrome plated. All label plates for the instruments and controls are to be of polished white metal with engraved enamel filled lettering.

Two folding seats designed for bulkhead mounting constructed in accordance with BuShips Dwg. #S3306-607230, Federal Stock Catalog G-2090-368-4789 shall be installed; one port and one starboard, in the wheelhouse secured to the forward bulkhead. The lining of the bulkhead shall be properly backed with steel supports to take the seats.

One binocular box, BuShips Dwg. #805-174907, shall be installed in the pilot house where directed. The Contractor is to also install on teak back boards a clock and chronometer case and clinometer furnished by the Owners.

Engine control stand in bridge wing shall be of 1/8" steel painted black, with front removeable for access to chain leads for propeller pitch control.

ENGINE ROOM

The Contractor is to furnish and install one steel log desk in accordance with BuShips Dwg. #S3209-921651 as indicated in the plans. The gauge boards, instruments, etc., shall be generally grouped around the log desk and the Contractor is to mount an Owner-furnished clock, and is to provide and install one cork faced, plywood backed, hardwood trimmed, bulletin board approximately 24" x 30", and one similar plywood backed hardwood trimmed blackboard of about the same dimensions in the area of the log desk where directed.

The Contractor is to furnish and install one only waste can, Federal Stock No. G7240-286-534, secured in place by clips or straps to suit the location.

SHIP'S BELL

The Contractor shall furnish and install one 8" Coast Guard approved, brass ship's bell to be mounted where directed.

SECTION 25 - DUMBWAITER

One electric dumbwaiter shall be provided to carry materials from the main deck to the lower deck at frame 20 as indicated in the plans. The trunk for the dumbwaiter shall be 27" x 36". The 36" length at the top will be reduced by the taper of the house. Interior car dimensions shall be 24" x 20", except that the cage car length at the top may have to be reduced because of the house taper. The dumbwaiter car shall be 42" high, be fitted with a solid bottom and one solid intermediate shelf. The car shall be open at the sides and at the ends. The car shall be constructed of galvanized steel. The dumbwaiter operation shall be electric using machinery as manufactured by D.A. Matot, Inc., or equal. The hoisting machine shall be especially designed worm gear elevator type motor with high starting torque and low starting time. The brake is to be magnet type spring applied and electrical release. The hoist shall be a traction cable of sufficient capacity to safely support the dumbwaiter. The dumbwaiter shall be designed for a maximum capacity of 250 lbs, plus the car. The dumbwaiter shall be equipped with suitable guides, sheaves, cables, etc., as required. The operation of the waiter shall be a fully automatic call and send with a full bank of

push buttons at each landing; i. e., one at lower deck and two at the main deck. In-use light shall be mounted in the pushbutton plate and shall be illuminated to indicate the dumbwaiter is in operation.

A coil buzzer is to be mounted on the car and arranged to sound when the selective button is pushed to indicate that a hatchway door is open. The hoist machine shall be located at the bottom of the hoist on a steel foundation . Interlocks shall be provided to prevent the operation of the dumbwaiter when any of the doors are open. Push-buttons and lights at the forward main deck section shall be mounted in a watertight box with a hinged watertight cover.

SECTION 26 - ANCHOR HANDLING & MOORING

WINDLASS

One anchor windlass shall be furnished and installed on the forecastle head. The windlass is to be "Markey" Type WEWD-18, of the unit-mounted type providing one wire rope and one wildcat suitable for 1-1/8" stud length chain. Two 15" gypsies shall be provided on the main shaft. The windlass is to be worm geared type with a motor and brake mounted on the base.

The wildcat is to be single cast steel mounted on the starboard side of the horizontal main shaft. Wire rope drum shall have capacity to stow 1200 ft. of 3/4" wire rope and one outer layer of 3/4" diameter stud link chain. The windlass shall be electric driven, 440 3-phase AC motor with an electric brake, waterproof lever operated master switch providing 5 speed points in each direction.

The warping gypsies, wire rope drum, and wildcat are to be carried on a horizontal main shaft. The drum and wildcat will be provided with independent clutches, each provided with a hand operated lined hand brake. The drum shall incorporate a holding pawl.

Main gearing is to be of the worm type with spur gears used for the high speed set. The gearing is to be totally enclosed running in oil. The motor and brake are to be mounted on an extension of the main base. Construction of the windlass is to be all steel, utilizing either steel casting or stress relieved welded fabrication for major components. Means shall be provided for access to all moving parts, and means shall be provided to lubricate all bearings.

The windlass is to have the capacity to lift the anchor and 105 fathoms of 1-1/8" chain at an average chain speed of not less than 36 feet per minute.

ANCHORS

The Contractor is to provide one 1365 lb. standard stockless anchor stowed in the chain pipe on the starboard side. The Contractor is also to furnish a 500 lb. Danforth, or equal, galvanized light weight anchor for streaming from the bow at the forecastle head, and is to provide stowage for it by means of plate chocks and securing clamps on the forecastle deck. Danforth anchor shall be fitted with a balancing band for lifting aboard.

CHAIN AND CABLE

The Contractor is to furnish 105 fathom 1-1/8" standard wrought iron stud link chain. The chain shall be furnished in 15 fathom shots and fitted with the necessary anchor shackles, swivels, connecting links, etc. Inboard links of the chain shall be shackled to a heavy padeye located close to the main deck on bulkhead 7.

The Contractor shall furnish 5 fathoms of 3/4" stud link galvanized chain and 1200 ft. of 3/4" 6x19 plow steel wire rope. The chain links shall be fitted with swivels and the wire rope shall be secured to the chain by means of a poured socket.

HAWSE PIPES

The shell bolster for the hawse pipe shall be of cast steel welded to the shell. The deck bolster shall similarly be of cast steel and the pipe between the deck and shell bolsters may either be cast steel pipe or heavy plate weldment. The internal diameter of the hawse pipe shall be adequate to take the anchor shackle and the shape and layout of the hawse pipe shall be such that the anchor will be self-stowing without the necessity to turn it manually as it comes up, and shall be shaped so that the anchor will stow with the

flukes either tight against or within 1/2" of the shell plating. The stowage shall be such that the anchor shall be secure and not rattle when stowed. The deck bolsters shall be properly sloped and sized to provide a fair lead to the wildcat.

CHAIN STOPPER

One tongue type, cast or welded steel chain stopper, "Markey", or equal, on a welded steel foundation with bronze bushed pin for the tongue shall be installed between the deck bolster and the wildcat.

CHAIN PIPE

Chain pipe shall be either of steel pipe or steel weldment of the size to suit the chain and be welded to both the main deck and the forecastle head. The lower end of the chain pipe shall extend not less than 6" through the main deck and the ends shall be belled either by a casting or by belling the actual pipe to provide a free lead from any part of the chain locker to the pipe.

CHAIN LOCKER

Chain locker shall be fitted between frames 4 and 7 between the lower and main decks as indicated on the contract plans.

BOW FAIRLEADS

The Contractor shall provide and install one "Berger" or equal rotating fairlead of a size suitable to take 3/4" wire rope and to permit the passage of the 3/4" stud link chain.

ANCHOR DAVIT

One steel pipe anchor davit shall be provided at the bow of sufficient outreach and capacity to lift the 500 lb. Danforth anchor from its stowed position on deck and swing it over the side. The davit shall be set in a bronze bushed pipe support on the deck. The davit shall be provided with Manila vang and Manila falls complete with the necessary blocks, etc., to allow the hoisting load to be applied by the anchor heads and the windlass. Davit shall be galvanized after fabrication.

MOORING LINES

Manila hawsers, heaving lines, etc., will be furnished by the Owners.

SECTION 28 - DESIGNATION

GENERAL

The Contractor is to provide all marking and designations and to furnish all signs and notices, and to provide all labels as required for a completed oceanographic and fisheries research vessel by the U. S. Coast Guard and the U. S. Customs Service. Except as specified otherwise below all labeling will be done by stenciling with the size of letters provided in accordance with Government regulations. The Contractor shall deliver with the vessel one sheet brass stencil of each sign or label used on the vessel.

NAME OF VESSEL

The vessel's name and hailing port is to be placed on the transom in name letters 8" high cut out of 1/8" steel plate welded on and painted in a contrasting color. The boards shall be secured by clips welded to the house, leaving enough room behind for maintenance.

DRAFT MARKS

Draft marks shall be placed on the hull at each end of the vessel ranging from 4' to 11', and located to the satisfaction of the

U. S. Coast Guard. Draft marks shall consist of arabic numerals cut out of 1/8" plate and welded to the hull. They shall be elongated as required so they will be true 6" high in vertical position.

ADMEASUREMENT

The vessel shall be admeasured and the vessel's official number marked as required by the Customs Service Admeasurement Office. Labeling of individual compartments, etc., as may be required for exemptions will not be required.

COMPARTMENT LABELING

No labeling will be required for individual compartments, hatches, manholes, doors, etc.

LABELING OF OPERATING GEAR & SOUNDING TUBES

The upper ends of all sounding tubes and the operating stations for valve operating gear, watertight door operating gear, etc., and other operating stations are to be designated by brass engraved enamel filled labels securely fixed to the unit or the adjacent structure. Operating instructions on the plates are to be as required by the U. S. Coast Guard.

MACHINERY & PIPING SYSTEM LABELS

All pumps, machinery, tanks, and other units of equipment shall be labeled by stenciling their name in a conspicuous space on the equipment or tank.

Engraved brass enamel filled plates shall be placed on all valve hand wheels where the use of the valve is not obvious. Example, pump suction and discharge valves are not to be labeled if there is only one suction and one discharge valve--where there are more than one, labels will be required.

Gauges and other instruments shall be labeled clearly to show their service.

MARKING OF LIVESAVING EQUIPMENT

All life preservers, ring buoys, life boat equipment, life boat, life raft, etc., shall be stenciled as required by the U. S. Coast Guard.

MARKING OF FIRE EQUIPMENT

All fire stations, fire hose, portable extinguishers, etc., shall be marked as required by the U. S. Coast Guard.

SPECIAL COAST GUARD MARKINGS

All special Coast Guard markings such as watertight doors, exit signs, rudder direction, embarkation directions, etc., are to be provided by the Contractor.

NOTICE FRAMES

Notice frames of the number and location as required by the U. S. Coast Guard for station bills, safety first notices, compass deviation cards, pilot rules, rules for lights, stability letter, etc., are to be provided and installed by the Contractor.

Notice frames may be of wood with clear glass. All frames are to have clips for removeable backs.

ELECTRICAL LABELING

All switchboards, distribution panels and electrical controllers shall be labeled and have their individual switches, instruments, etc., properly designated with phenolic labels. All cables shall be labeled with embossed aluminum tags secured to the cables giving circuit designations. The tags shall designate each cable run at each end and once in each intermediate compartment through which the cable passes. The tags shall be secured at accessible points.

SECTION 29 - STABILITY & ROLL

FLUME STABILIZATION SYSTEM

In order to limit the amount of roll, the vessel is to be equipped with a FLUME STABILIZATION SYSTEM of the type developed by John J. McMullen Associates, Inc. The Contractor is to retain the McMullen firm for the design, model basin testing, inspection, supervision, and on-board testing of this installation.

The FLUME STABILIZATION SYSTEM shall consist essentially of a tank located below the lower deck between Frames 21 and 22-1/2. The tank shall be fitted with nozzles (restrictions) of the size and shape required to provide the proper restriction of water flow in order to reduce the amount of roll. The arrangement shown on the contract plans is tentative and the exact arrangement of nozzles is to be as determined by the Contractor to provide the roll reduction as specified. The restrictions consist generally of internal bulkheads. Since the spaces back of the bulkheads are not accessible for maintenance, they are to be constructed with portable bolted plates to allow proper access for cleaning and are to be water tight.

The flume stabilization tank will be filled with fresh water from a shore hose through a 2" diameter flush deck plate fitted on the main deck at the starboard side.

Sounding pipes, overflows, and vents shall be fitted in general as indicated on the contract plans.

A remote reading gauge system, liquidometer, or equal, shall be installed to indicate the water level in the flume tank both port and starboard. The gauge indicator station shall be in the engine room.

GUARANTEE

The Contractor will guarantee that the flume tanks filled to the level designated by him will result in a 75% roll reduction in a given sea. This means that when the vessel is operating in a seaway with the tank filled and activated during a given period of time there will be 75% less rolls equal to 2° or more than there will be with the ship operating in the same seaway with the tank empty. The efficacy of the tank rolling system is to be demonstrated by tests as specified below.

Since effective determination of roll reduction requires operation in the open sea and with sea conditions as rough as possible,

determination of the roll reduction during the regular acceptance trials is impractical. Therefore, a conditional acceptance will be given the builder after satisfactory completion of all work and all other tests required by these specifications.

In order to determine the roll reduction, recording instruments are to be placed aboard by John J. McMullen Associates, Inc. at the time of the initial delivery of the vessel. John J. McMullen Associates, Inc. will provide an observer and operator for a period of approximately one week after the vessel leaves the shipyard. The Owners will operate the vessel in the heaviest sea conditions available both with and without water in the flume tank. For purposes of the test minimum sea conditions shall be Sea State 3 (WMO Code 75), or greater, as defined in H. O. Publ. 607, and as determined by the Government representative. Swell conditions shall be 1 or greater, as defined in the above-referenced publication. The instrumentation provided by the Contractor is to accurately record and plot the degrees of roll encountered against the number of roll cycles in these varying conditions, and is to demonstrate by these records the guaranteed roll reduction.

In the event the reduction in roll does not meet the guarantee, the Contractor will be responsible for changing the

configuration, or making whatever alterations are necessary to the tank at his own expense in order to obtain it. Should changes be necessary, liquidated damages as specified for delay in completion will be assessed for every day the vessel is out of service for the correction of the deficiency, including running time to get the vessel to the shipyard.

CONCRETE BALLAST

The Contractor is to furnish and stow ten tons, 22,400 lbs., of ballast in the form of concrete blocks in the following locations:

- (a) Two tons at the upper deck level port side at frame 20-1/2 (approx.)
- (b) Three tons at the upper deck level just aft of the deck house at frame 24.
- (c) Five tons in the hold at frame 17-1/2 to 18.

Concrete shall be in block form at a density of 150 lbs. per cu. ft., and shall be secured in place with welded steel straps to prevent shifting.

SECTION 30 - STOREROOMS

Storage spaces shall be located as indicated on the contract plans.

The area under the forecastle head is to be used for bulk stowage. Three binboards constructed of 3 x 12 fir planks provided with channel or flat bar guides shall be located across the forward end of the forecastle head as shown on the contract plans.

Boatswain's stores space in forecastle head will be fitted with three shelves the width of the stowage area, each of 1/8" plate with a 2" forelip and with rolling battens about 6" above each shelf.

In the lower deck quarters space, the linen locker aft of frame 20 shall be fitted with three 1/8" plate shelves with 2" fore edges. The cleaning gear locker in the after part of the lower deck quarters space is to have one 1/8" shelf with a 2" fore edge located 5' above the deck. Linen and cleaning gear lockers in the main deck quarters space shall be similarly outfitted.

The lower deck stores spaces forward are generally to be free of internal stowage fittings except for the refrigerated

bait stowage space which will have vertical battens generally as indicated on the contract plans. The battens shall be made from 3 x 3 fir timber, with galvanized steel sockets in the bottom and with clips fitted at the top of the type that allows the batten to be lifted out of the bottom socket and then removed from the top clip.

In the steering gear space and machine shop aft of the engine room the Contractor is to install three shelves in the starboard side against bulkhead 28 of approximate size and spacing as indicated in the contract plans. The shelves shall be of 1/8" plate suitably supported with light angle stiffeners fitted with flat bar rolling battens on the after edge. 1/8" end plate is to be fitted on the inboard edges of the shelves running from deck to deck, and one intermediate vertical divider plate of 16 gauge steel.

The scuba gear locker on the main deck aft will be fitted out with two shelves 18" deep located 42" and 60" above the deck. The shelves will be 1/8" plate with 2" forelips and with rolling battens on the after side.

SECTION 31 - SPARE PARTS

OWNER FURNISHED EQUIPMENT

All spare parts for Owner-furnished equipment will be furnished by the Owner.

CONTRACTOR FURNISHED EQUIPMENT

The Contractor is to furnish and stow on board the vessel spare parts in accordance with the requirements of the American Bureau of Shipping for the following equipment:

- (a) Main propulsion diesel engines, reduction gears and controllable pitch propellers, including control systems.
- (b) 60 KW auxiliary generators
- (c) Steering system.

On all other items of machinery and equipment the Contractor is to obtain from the manufacturer a list of spares as recommended for one year's operation. The lists are to include unit prices and full data as required for purchasing. If directed by the Contracting Officer the Contractor is to procure such of these parts as may be directed by the Contracting Officer under an approved change order.

SECTION 32 - OFFICE & LABORATORY SPACES

SCIENTIFIC INFORMATION CENTER

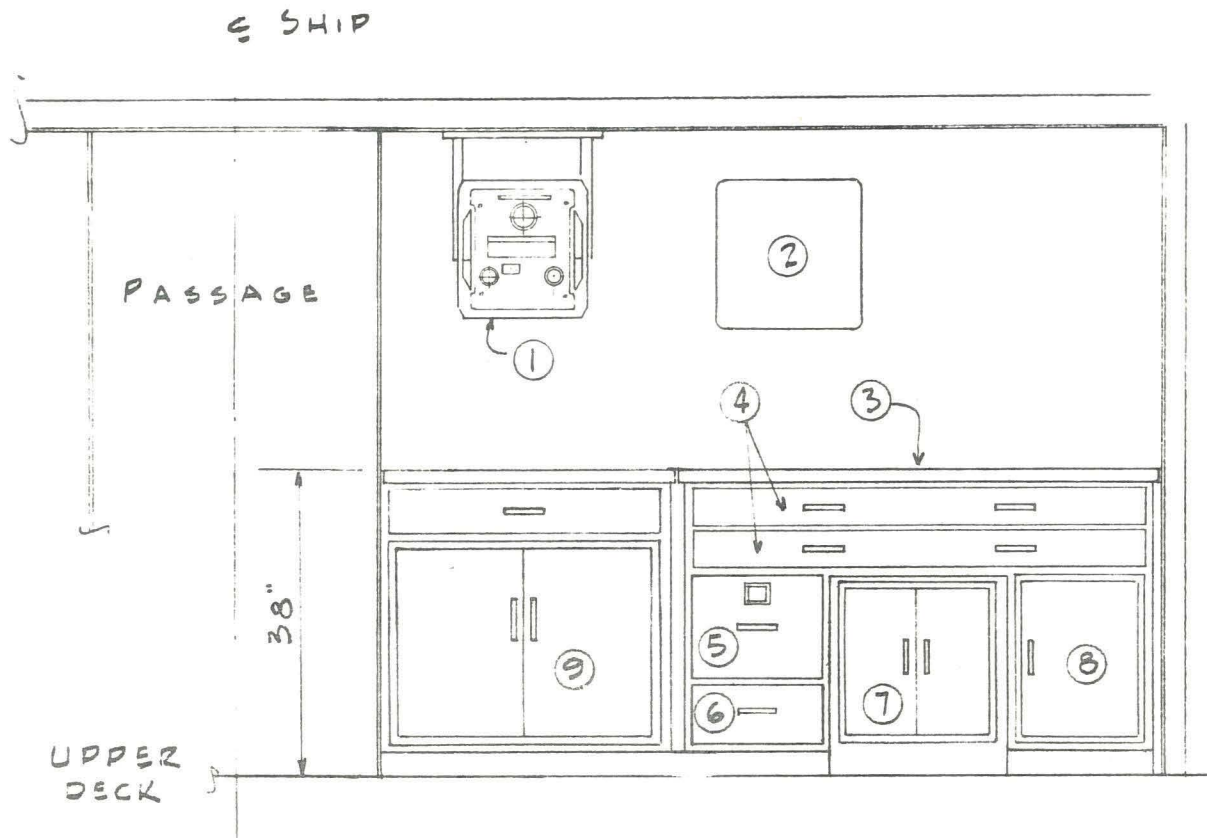
The Scientific Information Center is to be located on the starboard side of the upper deck house where indicated on the plans. The center is to be outfitted with the following equipment:

- (1) Two chart tables; one for scientists located on the after side of the space, and one for the navigator on the forward side of the space. Chart tables will be arranged with drawers and stowage cabinets below generally as indicated on sheets 32-1 (1) and 32-1 (2) herein. Construction generally is to be of steel and generally in accordance with Specification MIL-F-902.
- (2) Three aluminum leather covered chairs equal to Federal Stock No. G7105-290-8390.
- (3) One book rack, Type "B", in accordance with BuShips Dwg. #S3306-871735.
- (4) One wastebasket.

In addition, Contractor is to provide hardwood bases and mount Owner-furnished clock, barograph, barometer, thermograph and wind direction indicator.

RADIO ROOM

The Radio Room is to be located on the upper deck house



1. LOZAN SET.
2. EDO SET.
3. NAVIGATOR'S CHART TABLE.
LINOLEUM TOP.
4. CHART DRAWER, $3\frac{1}{2}$ " DEEP.
5. FILE DRAWER: 16" W. x 12" D.
6. DRAWER: 16" W x 6" D
7. CABINET, ONE SHELF.
FRONT RECESSED.
8. CABINET: ONE SHELF.
9. CABINET FOR LOZAN &
EDO EQUIP. DRAWERS/
SHELVES AS REQ'D.

ELEVATION:
- FWD END OF SCIENTIFIC INFO CENTER -

1 SCIENTIST'S CHART TABLE
LINOLEUM TOP.

2 CHART DRAWER - $3\frac{1}{2}$ " DEEP.

3 FILE DRAWER: 16" W x 12" D.

4 DRAWER 16" W x 6" D.

5 CABINET: ONE SHELF.
FRONT RECESSED.

6 CABINET: ONE SHELF.

7 BATHYTHERMOGRAPH STOW
LKR: FITTINGS AS REQ'D.

8 BOOK RACK w/ BATTENS.

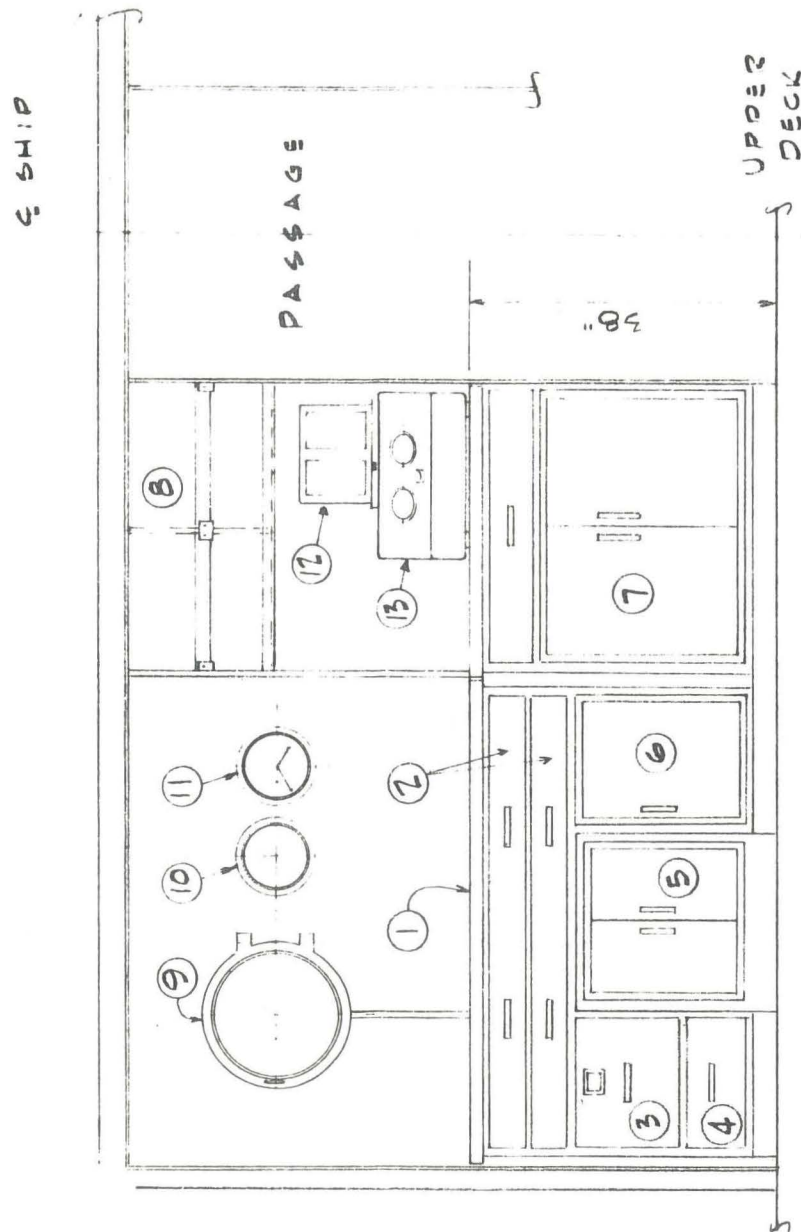
9 THERMOGRAPH.

10 BAROMETER.

11 CLOCK.

12 BAROGRAPH

13 WIND INDICATOR.



ELEVATION:
-AFT END OF SCIENTIFIC INFO CENTER-

as indicated in the contract plans. The room is to be outfitted with the following equipment:

- (1) One built-in bench of the approximate size indicated in the contract plans. The bench is to have a 3/4" marine plywood top covered with 1/8" linoleum with Philippine mahogany trim all around. One two-drawer letter size file cabinet is to be installed below the bench.
- (2) One chair, Federal Stock #G7105-290-8394.
- (3) One safe locker, Federal Stock #G7125-243-2363.
- (4) One book rack, Type "B", Federal Stock #F7105-264-4859.
- (5) One light metal enameled wastebasket.
- (6) One hinged fir workbench, 1-1/2" thick.

In addition, the Contractor is to provide a hardwood base and mount an Owner-furnished clock.

LABORATORIES

Outfitting of the Chemical, Biological, and Hydrographic Laboratories is to be as indicated and detailed on the contract plans. General construction of Nansen bottle racks, counter tops, etc., shall be as detailed. Construction of drawers under cabinets shall be

generally in accordance with construction details of specification MIL-F-902. In general, drawer fronts, faces of cabinets, etc., shall have a baked enamel finish to match other furniture. The chair in the Biological Laboratory shall be Federal Stock No. G7105-290-8390. The single pedestal typewriter desk shall be Federal Stock No. G7110-267-1979. Drafting stools for the Chemical Laboratory and Biological Laboratory shall be Federal Stock No. G7195-281-6260. Refrigerator for Biological Laboratory is to be Acme National Refrigeration Co. Model 6 D6IF, or equal.

Light metal wastebaskets shall be provided for both the Chemical Laboratory and the Biological Laboratory. The Contractor shall install Owner-furnished clocks on teak base mounting boards in all three laboratory areas.

The "Wet Laboratory" on the well deck forward shall consist of a 1/8" galvanized steel dresser and sink of size indicated on the plans supported on angle framework and with 12" splash plates at the back and outboard ends, and with the forward and inboard edges flanged down 3". One 18" wide shelf of 1/8" galvanized steel plate with edges turned up 2" all around shall be fitted under the dresser with 3/4" holes for drainage.

SECTION 33 - LIVING & BERTHING SPACES

Living spaces shall be arranged generally as indicated in the contract plans, with furniture and fittings as shown and as specified below.

All furniture shall be equivalent to the quality and construction set forth in specifications MIL-F-902 and MIL-C-903. For identification the standard drawing numbers of the Bureau of Ships have been used, or where available, standard federal stock numbers. All furniture except portable chairs shall be properly secured in place. Where commercial quality has been specified it shall be first class suitable for marine service.

Straight chairs shall be Federal Stock #G7105-290-8390. Straight chairs with arms are to be Federal Stock #7105-290-8394.

Key cabinets shall be Federal Stock #G7125-355-4839.

Book rack, Type "B", shall be Federal Stock #7105-264-4859.

Chiffoniers shall be as shown on BuShips Dwg. #S3306-630290, except that they may be constructed of steel instead of aluminum at the Contractor's option.

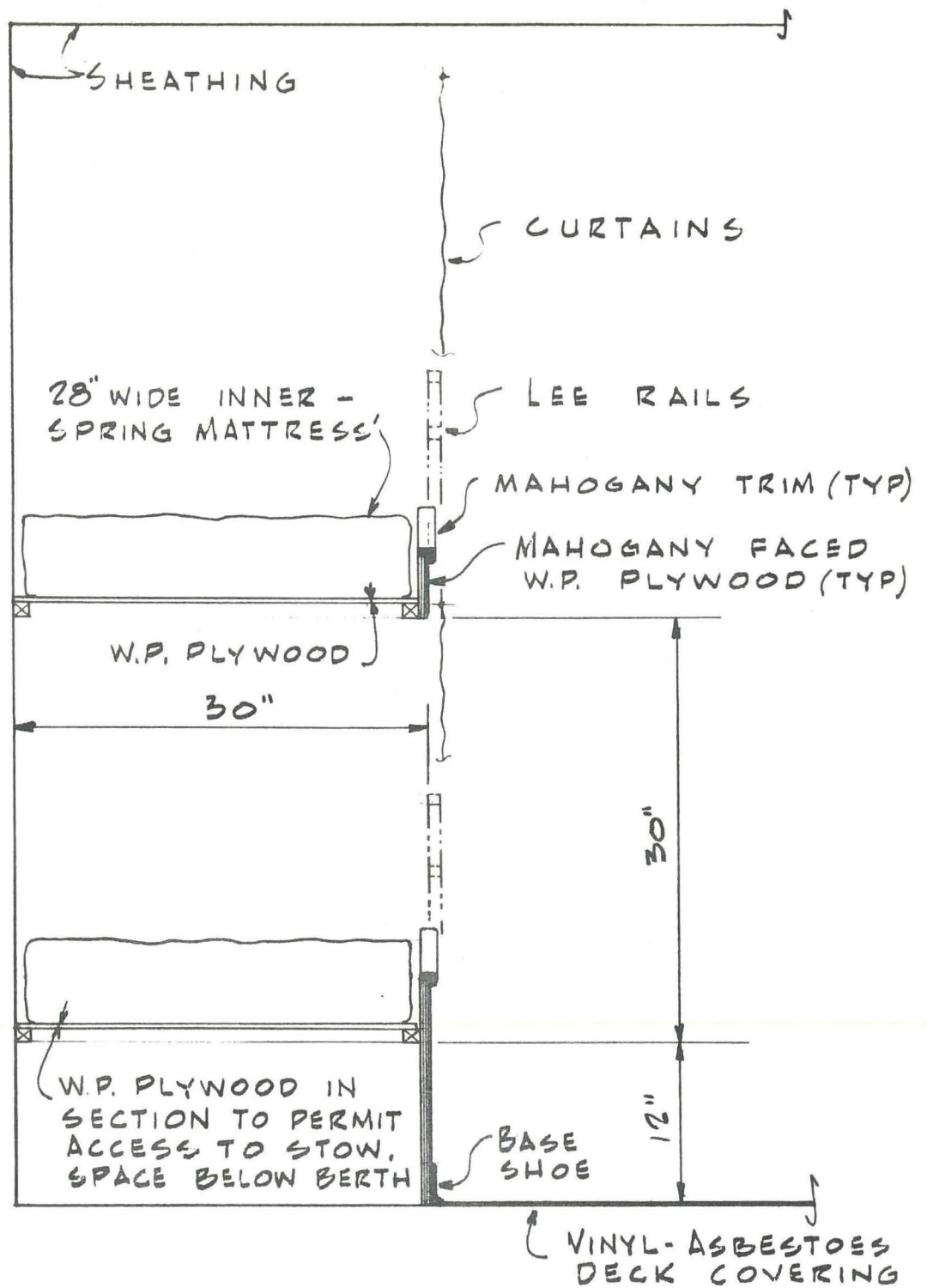
Secretary-Bureaus shall be in accordance with BuShips Dwg. #S3306-632543, except that they may be steel in place of aluminum at the Contractor's option.

Clothes lockers in staterooms shall be 18" wide x 21" deep x 66" high. The lockers shall be of steel, baked enamel finish, with sloping top, and with interior shelves, coat hooks, coat rod, etc., in accordance with Maritime Administration standards for crew's lockers.

Berths in the accommodation spaces shall be built-in of wood, in accordance with general layouts shown on page 33-2 (1) herein. All plywood used in construction shall be of marine quality. The hardware shall be white metal matching other furniture. The mattresses shall be innerspring type, first class quality, Simmons, or equal. Curtains shall be Monk's Cloth, complete with brass rods and ties.

Wastebaskets shall be standard light metal, green enameled.

Night trays shall be constructed of 20 gauge steel baked enamel 12" long and 6" wide with a 1" lip. They are to be secured to the bulkheads adjacent to the head of each berth as directed.



SECTION THRU
CREW'S BERTHS

The built-in clothes lockers in the cook's and mess boy's stateroom, and the chief scientist's stateroom shall be fitted with one plate shelf 5' above the deck with a 1" fore edge, with four coat hooks and with a pipe coat rod below the shelf.

Two bulletin boards shall be furnished located one in the wardroom and one in the passageway in the lower deck quarters. The bulletin boards shall be Type "B", Federal Stock #G7195-224-5191.

The Contractor shall mount on teak backboards Owner furnished clocks in the Captain's Chief Scientist's and Chief Engineer's staterooms.

The furniture in the various berthing spaces shall be as follows:

Captain's Stateroom

One single chair, one book rack, one single berth, one secretary-bureau, one night tray, one key cabinet, one clothes locker.

Chief Scientist's Stateroom

One single chair, one book rack, one single berth, one secretary-bureau, one night tray.

Chief Engineer's Stateroom

One straight chair, one book rack, one single berth, one clothes locker, one secretary-bureau, one night tray.

Crew & Scientists Staterooms

Each stateroom on the main deck for scientists and each stateroom on the lower deck for crew is to have the following equipment:

One double berth, one book rack, Type "B", two night trays, two clothes lockers, one chiffonier.

SECTION 34 - GALLEY & COMMISSARY

GALLEY AND WARDROOM SPACES

The Contractor is to provide all equipment and cabinets for the galley as indicated on the contract plan "Galley Arrangement and Details". The Contractor is to take particular care in the construction of the galley to insure that there are no cracks or dead corners for food particles and materials to collect. Construction of the cabinets and equipment shall be readily cleaned and all parts accessible for inspection.

The Wardroom arrangement is to be as indicated on the contract arrangement plans. The Wardroom is to have the following equipment:

- (1) Four crew's mess tables with attached seats, each to seat four people in accordance with BuShips Dwg. #805-1749035.
- (2) One special mess table in the forward part of the room 42" wide by 72" long. The mess table shall have two fixed pipe pedestals welded to the deck and a steel angle framework on top of the pedestals to support a top, of construction and finish duplicating the other mess tables.
- (3) Four straight chairs with arms, Federal Stock #G7105-290-8394.

- (4) One transom. The transom shall be built-in around the forward mess table of the shape and size shown on the contract plan. The transom shall be of steel angle framework with solid plate front and ends. Seats and cushions shall be plywood backed with not less than 2" of molded foam rubber on the seat backs and 3" on the cushions over sisal filler, covered with a "Naugahyde", or equal, minimum 32 oz. plastic back plastic coated fabric in an approved color. The seat backs shall be fixed, but seat cushions shall be removeable. Space under the transom shall be available for stowage.
- (5) One sideboard - 72"; Federal Stock #G7105-372-0612.
- (6) One bookcase, Federal Stock G7110-269-1239.
- (7) One mail tray, Type "A", Federal Stock #G7110-371-8083.

The Contractor shall install one Owner-furnished clock on a teak back-board where directed.

SECTION 35 - LAUNDRY

The Contractor shall furnish and install one combination washer-dryer, "General Electric" Model WD-860W, or equal, in the main deck washroom space where indicated on the contract plans.

SECTION 36 - SANITATION

GENERAL

Sanitary fixtures and accessories as indicated in the contract plans and as specified herein are to be furnished and installed by the Contractor. All plumbing fixtures and accessories shall be of high grade marine type. The fixtures described and model numbers indicated are taken from the American Standard Co. Catalog and are not intended to be restrictive. Similar fixtures of equal quality are acceptable. All trim of fixtures is to be chrome plated brass. All necessary supply and drain pipes shall be installed for satisfactory operation. Stop valves are to be installed in all supply lines at the head of the plumbing fixtures or adjacent thereto. All exposed supply piping and drain piping to lavatories in staterooms shall be chromium plated. Supply and drain piping in toilets proper may be supplied with paint finish.

LAVATORIES

Lavatories shall be installed in stateroom and toilet spaces as indicated in the contract plans. Lavatories shall be American Standard Model P 4300, 18" x 15" cast iron enameled

with self-closing valves with chain and rubber stopper.

All water closets indicated in the plans shall be American Standard Model F-2469 with Church sani-black open front seats without cover, and with spring hinges.

All showers indicated in the plans shall be fitted with both hot and cold fresh water and with salt water showers. Fresh water showers shall have fittings similar to American Standard Model MR1255 or 1256, chrome plated. Salt water showers shall be similar in design to the fresh water showers, with the same "Boyd" type shower heads and with a similar manual type shower valve. Cold saltwater only is to be provided in the saltwater showers.

Each shower stall will be provided with one chromium plated soap dish, one chromium plated towel bar, and with a chromium plated shower rod and fittings and a heavy plastic shower curtain.

Each toilet shall be outfitted with one toilet paper holder, "Crown Zellerbach", "National", or equal, with lock sized 5" x 8" for use for the single fold tissues.

For each wash basin in the washrooms the following shall be provided:

- (1) One plate glass mirror, 18" x 24" "Palmer" wall type.

- (2) One 5" x 18" Monel or chrome plated shelf.

For each wash basin in staterooms and for individual toilets attached to staterooms there shall be provided the following: one washroom cabinet, Federal Stock #G7125-369-4566; one free-arm swinging chrome plated towel rack with serrated edge.

SECTION 37 - MEDICAL SPACES

Hospital space is to be located in the upper deck house as indicated in the contract plans, outfitted with the following equipment:

1. Two hinged berths in accordance with BuShips Dwg. #S3702-614396.
2. Hinged Operating Table in accordance with BuShips Dwg. #S3702-518664.
3. One book rack, Type "B" (See Section 33)
4. One straight chair (See Section 33)
5. One medical locker, BuShips Dwg. #S3702-851544
6. One medical locker, BuShips Dwg. #S3702-921575
7. One first aid box, BuShips Dwg. #S3702-921917
8. One wastebasket.

In addition to the medical equipment in the hospital, one first aid box, BuShips Dwg. S3209-866181, is to be mounted on a bulkhead where directed in the lower deck crew's quarters.

Stowage for an Owner furnished "Stokes" litter shall be provided on the upper deck where indicated.

SECTION 38 - VENTILATION, HEATING & COOLING SYSTEMS

All quarters in the vessel will be heated and cooled by means of mechanical ventilation installed in accordance with the methods shown on the contract ventilation diagram. Heating and cooling will be done by means of hot or chilled water circulated through coils in the ventilating ducts and through convectors in the washroom spaces. Natural supply exhaust ventilation is provided in some spaces as indicated, but the bulk of the system is mechanical.

Where fans are specified on the ventilation diagram they are to be Navy standard. The Navy standard sizes are given for capacity and performance only. Commercial standard or Maritime Administration standard fans having equal performance characteristics may be used by the Contractor.

The required air deliveries are given on the contract ventilation diagram. Duct sizes are to be developed by the Contractor to suit space limitation. Duct sizes, velocities, and duct construction shall be all in accordance with Navy standard practice as outlined in Section S38-1 of the Navy General Specifications.

Ducts shall be aluminum.

All-weather terminals shall meet the requirements of the American Bureau of Shipping and the United States Coast Guard, and shall be fitted with bronze insect screens.

The Contractor may at his option use the "Hi-Press" type of air delivery air cooling and heating system. If the "Hi-Press" system is used, however, the Contractor shall assume complete responsibility for the system design and complete detailed calculations shall be submitted to indicate that the system will meet the required design conditions.

The system shall be capable of maintaining an inside temperature of 80° F. and 50% relative humidity with outside air and water temperatures of 86° and outside air relative humidity of 90%. In addition the heating system shall maintain a 75° inside temperature with plus 10° outside air temperature and plus 28° outside water temperature.

On completion of the system installation it shall be completely balanced by the Contractor to demonstrate that the required air deliveries are being made to all spaces. Dampers shall be set and adjusted and should the deliveries vary from those

indicated in the contract diagram orifice plates shall be installed
or ducts shall be revised as required.

SECTION 39 - INSULATION, SHEATHING, LININGS, AND JOINER BULKHEADS

HEAT INSULATION

Heat insulation consisting of 2" thickness Fiberglas having a density of .75 lbs./cu.ft. equal to Johns Manville "Micro Lite" is to be applied in the spaces listed below. Insulation is to be held in place by mechanical welded clip fasteners.

- (a) The insides of the shell between the lower and the main deck in the stores space and passenger quarters, frames 17 to 24 on the lower deck.
- (b) The underside of the main deck over the stores and passenger quarters, frames 17 to 24, where not covered by the main deck house. Insulation shall extend under the deck house for 2' along its edges.
- (c) The interior surface of the sides and ends of the main and upper deck houses and pilot house where exposed to the weather.
- (d) The entire deck head of the main deck house, except where covered by the upper deck house, and the deck head of the upper deck house and pilot house. Insulation on the deck head of the main deck house shall extend 2' in from the side of the upper deck house.
- (e) The bulkheads between the stair enclosure and the chemical laboratory at the main deck level.

ENGINE ROOM INSULATION

The entire deck head of the engine room, including the

area under the deck house, the sides of the machinery casing between the main and upper decks, and the shell of the ship from the lower deck stringer to the main deck in the engine space, shall be insulated with 2" thickness Fiberglas insulation having a nominal density of 3 lbs. per cubic foot, covered with a glass cloth surface, equal to Johns Manville marine hull board. Insulation shall be fitted completely around all stiffeners in the machinery casing, but on the deck head and side shell of the machinery space proper it shall be fitted between the beams and frames only. Marine hull board shall be taped at all joints and at the edges with a fiberglas tape and shall be held in place by the mechanical welded fasteners.

ALTERNATE QUOTATION FOR MACHINERY INSULATION

The bidding documents require an alternate price for additional insulation in the machinery space. Under this item the Contractor is to quote on covering the entire deckhead of the engine space between beams and framing members with 2" "Micro Lite" low density thermal fiberglas insulation. The insulation is then to be covered by false ceilings suspended 1" below the web frames on light steel channel supports of 3/16" Johns Manville perforated, colored marine veneer. The veneer is to be applied in panels

secured to the steel supporting channels by stainless steel self topping screws for ready removal. The side shell of the machinery space above the lower deck stringers is to be covered with 2" marine hull board insulation, except that the board is to be fitted around the faces of all steel framing members.

REFRIGERATION INSULATION

The deck heads, the surfaces of the bulkheads and the side shell in the refrigeration spaces between frames 7 and 17 are to be insulated with a 3-1/4 lb. density material fiber felt similar or equal to Johns Manville's BX-Spintex. The insulation is to be applied in thicknesses to provide a 2" coverage over the deepest steel framing members. The insulation is to be neatly applied and secured with mechanical welded fasteners. The entire surfaces of the insulation is to be covered with a single layer of 13/16" tongue and groove fir sheathing nailed with copper nails to wood furring and studding securely bolted to the framing members.

The center line bulkhead between the ship's cooler and freezer space shall have one layer of 1-5/8" x 5-1/2" net studs covered with waterproof aluminum foil lined paper on the cooler side, with 13/16" fir T&G sheathing on both sides, and with BX-Spintex in between. Flooding plug shall be installed as required by the U. S. Coast Guard.

The deck in the refrigerated spaces shall be insulated with two layers of 2" compressed corkboard, making a total thickness of 4" of insulation. Cork shall be laid in hot asphalt with all edges dipped and covered, and with a float coat of asphalt over each layer. Fir studding members of 1-1/2" net fir shall be fitted at about 19-1/2" centers in the cork, the lower layer set athwartship and the upper layer fore and aft. On top of the cork the Contractor is to install a continuous layer of 1/2" marine grade waterproof plywood securely nailed. On top of the wood is to be a 1-1/2" cover of "Laycold". After the base coat is installed three "Laycold" wear coats are to be applied to the mastic. Twelve inch diameter drain recesses formed by reducing the mastic thickness to 12" shall be installed--two in the bait storage and one each in the ship's freezer and cooler. Grating sections over drain recesses shall be 12" square.

LININGS

The interior of the shell and the deck house sides will be lined with 1/2" plywood secured with brass screws to fir studs bolted by galvanized bolts to the steel framing members in the areas listed below. The plywood is to be marine grade, waterproof.

All linings are to be covered with a wall covering as specified later herein.

- (a) The side shell in the quarters and stores spaces on the lower deck, frames 17 to 24.
- (b) The sides of the main deck house aft of the biological and chemical laboratories, and the after end of the main deck house.
- (c) The sides and after end of the upper deck house.
- (d) The exposed sides and ends of the pilot house.

The front and sides of the hydrographic laboratory, and the house sides and steel bulkheads in the chemical and biological lab and locker off the chemical lab shall be lined with 1/4" "Masonite" hardboard, secured by screws to fir studding as specified elsewhere for the plywood, except for the bulkheads in the chemical laboratory next to the stair enclosure which shall be lined with 1/2" "Marinite" 36, surfaced for painting.

SHEATHING

The entire deck head of the main deck house, the deck head of the lower deck between frames 17 and 24, and the deck head in the upper deck house and pilot house are to be sheathed with 3/16" perforated marine veneer in the foam white color. Sheathing is to be suspended below the framing members at heights indicated on the

contract plans from a supporting framework of light steel channels. Veneer is to be fitted up in sections and secured by means of stainless steel self-tapping screws over stainless steel washers. The panel sections are to be neatly laid out to present a pleasing appearance. Where sheathing fits against bulkheads, house sides, etc., the joint is to be covered by a neat stainless steel molding secured so as to be removeable.

JOINER BULKHEADS

Joiner bulkheads are to be fabricated from two thicknesses of 5/8" fir particle board. Quarter inch steel plate coaming sills 6" high are to be provided for all joiner bulkheads. Two thicknesses of particle board are to be secured together by approved marine adhesive and bronze screws at about 12" centers along the edges. All joints are to be carefully spackled. Where bulkheads join against one another or against steel members they are to be held in place by 1" x 1" x 1/8" aluminum angles or their equivalent. The joint between the angles and the top molding against the deck head sheathing is to be neatly and carefully made. Bulkheads are to be supported at the top against furring held by angle supports from the deck head. The intention is that the bulkhead panels will

will be made up, have the wall covering specified below applied, and then be secured in place on board. The entire assembly of bulkheads, sheathing and lining is to be carefully and neatly developed for a pleasing appearance.

FABRIC WALL COVERING

Bulkhead and shell linings and joiner bulkheads shall be covered with a fabric wall covering. Surfaces shall be sanded and cleaned and material applied with an approved latex type adhesive.

Wall covering shall be a vinyl coated woven fabric. It must be at least 8.2 ounces/square yard in total weight. It shall be equal to "Prince Guard - Thai" as manufactured by the Columbus Coated Fabrics Co. Colors are to be as selected by the Owners.

BULKHEAD LINING

The after side of bulkhead 20 and the forward side of bulkhead 24 shall be covered with 3/16" "Ensolute", Type "F", applied with an approved adhesive.

ALTERNATE FOR USE OF MARINITE BULKHEADS,
SHEATHING AND LINING

The bidding documents require the Contractor to quote an alternate price for the use of "Marinite" in place of wood for the bulkheads and linings. Sheathing shall be Johns Manville 5/8" "Marinite 36" with a colored marine veneer on one side. Joiner bulkheads are to be 7/8" "Marinite 36" with colored marine veneer both sides.

Linings may be secured by screwing to wood furring strips bolted to the framing members, but joiner bulkheads shall be supported in a system of hollow heavy gauge steel framing members and moldings which will match metal door jambs. It will be noted that as a part of this alternate all interior wood doors are to be eliminated, and hollow metal joiner doors used instead. This means the door frames and the supporting members must match in general design and shape. With this system all wiring leads shall be concealed in the hollow metal framing members used for supporting the bulkheads. All metal members shall have baked enamel finish matching doors, furniture, door frames and corner moldings. The entire assembly shall be laid out for a neat and attractive appearance.

HOT WATER TANK INSULATION

The hot water tank shall be insulated with 85% magnesia block 1" thick covered with two coats of insulating cement, reinforced with diagonal wire mesh and lagged with 8" cotton duck glued on.

EXHAUST AND SMOKE PIPE INSULATION

Diesel exhaust lines and boiler smoke pipe shall be lagged throughout their entire length to 1' above the level of the bottom of the stack. This shall include mufflers as well. The lagging shall consist of metal lath providing 1/2" air space, 3 layers of fire felt, 2 layers of asbestos roll board, and asbestos cloth sewed on. Flanges may be left bare with the pipe insulation ended with just enough room to remove flange bolts. However, where flanges occur in the machinery space in areas where they could be touched by personnel they are protected by 18" galvanized guards covered by asbestos cloth.

Flexible exhaust pipes at the engine connections are to be covered with 18 gauge metal shields wrapped with two layers of asbestos cloth, with 2" air space left between the sheet metal and

the pipe flanges. The shields shall be flared out and over to protect the flanges. Particular care is to be taken where exhaust pipes and smoke pipes are close against the deck to get complete and thorough insulation coverage. Hangers on exhaust and smoke pipes shall be insulated by inserting "Micarta" blocks between hangers and structure and bolting through the blocks.

PIPE INSULATION

Hot water pipes throughout the ship shall be insulated with 85% sectional magnesia pipe covering of standard thickness secured with not less than 3 loops of 16 gauge wire. Lagging shall be 8 oz. canvas glued on. Sheet metal shields shall be fitted where insulation is subject to physical damage. Valves and unions in enclosed spaces need not be insulated except where personnel may be injured by physical contact.

Cold water lines throughout the entire closed portion of the vessel and above the floor plate level in the machinery space or the suction and discharge valve on the pump (whichever is higher) shall be insulated with compressed asbestos felt, Type "A" or "B" 3/4" thick in accordance with specification MIL-F-15091. Asbestos

felt is to be securely wrapped with 18 gauge galvanized steel wire covered with water repellant paper with all joints sealed with adhesive cement. 8 ounce canvas is to be glued on over the water repellant paper. Fire main and drain lines need not be covered except where they pass over electrical equipment.

REFRIGERATION PIPING

All refrigerant and chilled water piping throughout the vessel shall be lined with compressed cork insulation to standard chilled water or freezer thicknesses applied in accordance with the recommendation of the manufacturers and covered with canvas glued on.

VENTILATION AND AIR CONDITIONING INSULATION

All ventilation ducts, fans, coolers, etc., located in the void space in the pilot house which will be subject to contact with the surface air are to be insulated with not less than 1" of fiberglas insulation covered with canvas or glass cloth. Chilled water heat exchangers are to be insulated with block cork wired on, covered with mastic asphalt waterproof paper and canvas sewed on.

SECTION 40 - MACHINERY PLANT

GENERAL

The vessel is to be propelled by two diesel engines driving two controllable pitch propellers through reduction gears. The main engine space is aft and is to be arranged generally as indicated on the contract machinery arrangement. The machinery plant is to be furnished and installed by the Contractor in complete operating condition. Generators, evaporators, boilers, pumps, compressors, heat exchangers and other items of equipment are to be installed as specified herein and are to be piped and provided with electrical services, etc., all as generally indicated on the contract plans.

Generally the machinery arrangement indicates the type of installation and arrangement desired. The Contractor is to prepare a detailed layout of machinery based on the final selection of equipment. In making the detailed layout space is to be provided for adequate clearances for access to all machinery for repairs and replacement of parts.

In the selection of equipment, materials suitable for operation in ambient temperatures of 50^o Centigrade and water temperatures of 86^o will be required.

In order to provide a single source of contact for the Owners on matters of guarantee, etc., the Contractor is to procure the main diesel engines, the main propulsion reduction gears, and the controllable pitch propellers from the diesel engine manufacturer who is to guarantee the complete assembly. The manufacturer is to prepare, and secure the approval of the American Bureau of Shipping and the Owners, an analysis of torsional vibration of the propulsion system. The exact size of the shafting is to be based on this torsional analysis to insure that the entire system is out of the range of vibratory criticals. In the event any work is necessary to correct any malfunctioning of the engine, reduction gear or propeller assembly prior to acceptance of the vessel, the Contractor shall be fully responsible for the correction of such malfunction.

SECTION 41 - MAIN PROPULSION DIESEL ENGINES

The propelling engines for the vessel are to be medium duty, medium speed type manufactured by a concern recognized and experienced in the design and construction of diesel engines for maritime service and the engines proposed must be standard models having demonstrated their ability to meet the performance requirements by not less than 5 years actual service in ship propulsion.

The engines may be two or four cycle type and shall each deliver not less than 400 brake horsepower to a reduction gear coupling at an engine speed of not to exceed 720 rpm, and a piston speed of not in excess of 1250 fpm. Brake mean effective pressure for the main engines shall not exceed 85 lbs. per square inch for naturally aspirated engines or 130 lbs. per square inch for turbo charged engines.

Engines shall have wet sumps and shall be equipped with attached saltwater and fresh water circulating pumps, lubricating oil service pumps, fuel oil service and injector pumps (as required), fuel oil strainers and filters, engine speed regulating governors, and

over-speed trips. The engines are to be air started, equipped with a power takeoff for driving the hydraulic oil pump for propeller control and with attached air compressors. A gauge board may be mounted on the engine, or separately, giving the usual pressure gauges, thermometers, tachometer, and revolution indicator system. In addition, the engines shall have detached auxiliaries consisting of the jacket water cooler, lubricating oil cooler, lubricating oil strainer and lubricating oil full flow filter, exhaust silencers, air receivers, fresh water expansion tank, and flexible section of exhaust piping.

Diesel engine control shall be integrated with the propeller pitch control system. Engines shall be started in the engine room only and transfer of engine and propeller controls from the engine room to the wheelhouse shall be made in the engine room. An emergency stop shall be incorporated as part of the controls in the pilot house to allow either engine to be shut down from the pilot house in an emergency. Engine and propeller controls in the engine room shall be combined in a metal console located adjacent to the log desk.

ALTERNATE

As part of the bidding documents the Contractor is

required to quote an alternate price for furnishing diesel engines operating at higher speeds. All requirements set forth above for the basic engines shall be met except that the engine revolution limitation shall be 1225 rpm, the piston speed shall not exceed 1650 feet per minute, and the brake mean effective pressure for naturally aspirated engines shall not exceed 90, and for the turbo charged engines shall not exceed 135.

SECTION 42 - REDUCTION GEARS

Two main reduction gears shall be furnished by the engine manufacturer. They shall be single pinion, single reduction gears set to transmit full power from the engines to the propeller shaft operating at 325 rpm. The arrangement of the gears shall be generally as indicated on the contract plans. Each gear drive is to consist of one pinion, one bull gear shaft, the necessary anti-friction roller contact and thrust bearings, gear housing, and lubricating oil system. Flexible couplings shall be provided for each gear drive connecting the pinion shaft to the main engines. Lube oil pump, strainer, and cooler shall be supplied for each gear drive, with the pump driven from the gear train. The housing shall be fabricated from steel plate with cast steel hubs. Anti-friction bearings shall be designed for a minimum of 25,000 hours B_{10} life for journals and 50,000 hours B_{10} life for thrust bearings based on applied continuous duty ratings. Inspection covers shall be provided on the upper case. The gearing is to be double helical type to eliminate end thrust from the tooth load. The pinions are to be made from heat treated forgings; the main bull gear may be from a full forging or may be fabricated from forged steel hubs, steel plated arms and rolled alloy steel rims heat treated to 180 Brinnell minimum.

Pinions may have a Brinnell hardness of 225-250.

The low speed shaft shall be made of heat treated forced steel and have a shrunk-on and keyed flange for bolting to the propeller shaft. The bull gear shaft shall be bored to take the controllable pitch propeller controls which will be mounted on the forward edge of the gear case. The "K" factor shall not exceed 100 with 400 horsepower, and 325 rpm at the propeller shaft.

The reduction gear lubricating oil system shall be adequate to lubricate all parts of the gear assembly and to maintain adequate temperatures with 105 degree ambient temperature in the machinery space and 86⁰ sea water.

The reduction gear shall be manufactured under the survey of the American Bureau of Shipping and an inspection certificate shall be furnished. The facilities of the manufacturer are to be open for inspection of the work to the satisfaction of the U. S. Coast Guard and the Owner's representatives.

The following tests are to be conducted at the gear manufacturer's plant.

1. Speed tests at various operating speeds of such lengths of time to clearly establish satisfactory lubrication and noise and vibration characteristics.

2. Tooth contact tests shall be made after the speed tests.

The manufacturer shall open the gear cases and by blueing in the two surfaces demonstrate that adequate contact between teeth is being maintained.

During the speed tests temperatures of all bearings shall be recorded and the temperatures of leaving oil shall not exceed a temperature of 180°.

After the full power trials the gear shall again be examined by blueing in to check tooth contact. 85% contact will be required on the ahead faces.

SECTION 43 - SHAFTING AND BEARINGS

GENERAL

Propulsion shafting and bearings shall be installed as shown in the contract plans. Two shaft systems are to be installed from the reduction gear to the propeller through the stern tube and struts as indicated. The tail and line shafting shall be forged carbon steel to American Bureau of Shipping specifications. The diameter shall be determined by the propeller pitch control requirements, and the torsional vibration analysis. In way of the strut bearings and from the outboard end of the stern tube to the inside of the stuffing box the shaft is to be covered with centrifugally cast bronze liners at least 1/2" thick to meet the specifications of the American Bureau of Shipping. The after end of the after sleeve is to fit into a recess in the propeller hub and be suitably packed. Space between sleeves is to be covered with "Thiokol" or approved equal rubber compound installed by an experienced applicator in accordance with the manufacturer's recommendations. Couplings shall be installed as indicated. The propellers shall be key seated to the shafts with ample fillets in the key seats and sled type runouts.

The Contractor shall furnish and stow one heavy plate propeller nut wrench and one female template for the tailshaft taper.

STERN TUBE & STRUT BEARINGS

Strut bearings and stern tube are to be water lubricated Goodrich "Cutlass" rubber or equal, non-segmental type, with split bronze bearing shells. The bearing shells are to be split on horizontal center line with a straight taper for ease of removal. The outboard bearings shall be flanged at the outboard end and secured by bronze studs and nuts to the stern frame. Tapped holes for jacking screws are to be provided.

The inboard bearing is to be flanged at the inboard end and bolted to the inboard end of the stern tube. There is to be a bronze stuffing box of ample size bolted to the inboard end. The stuffing boxes at the end are to be split along the center line. The packing shall be high grade flax impregnated with tallow. Inboard bearings are to be provided with bronze lantern rings and connections for circulating water. Ample clearance is to be provided in the stuffing box to allow for bearing wear down.

Design and workmanship of the bearings are to be

to the best practice of the bearing manufacturer. Installation is to follow his recommendations.

SHAFT ALIGNMENT

The stern tube and strut supporting surfaces are to be finish bored in place after all structural welding has been completed in the hull. The bore shall be lined up with the correct position of the reduction gears and must be checked with a transit and sights.

After the strut and stern tube bearings have been installed and the shafts are in place the stern tube stuffing box is to be packed, being careful that the inboard end of the shaft is not cramped or thrown out of line.

After launching the shafts and reduction gears are to be aligned. All clearances are to be checked before final bolting up.

American Bureau of Shipping test certificates are to be furnished to the Owner's representative for all shafting.

SECTION 44 - PROPELLERS

The vessel is to have two propellers, one port and one starboard, controllable pitch, reversible type. The propellers are to be to opposite hand and are to be three-bladed approximately 5'-6" in diameter. The propellers are to have moveable and re-moveable blades and are to be constructed of nickle maganese bronze. The basic propeller design is to be supplied by the propeller manufacturer to the approval of the engine builder and the Owner. The propellers are to be equal to the "KaMeWa" as manufactured by the Byrd Johnson Co., or their Scandinavian affiliate.

If the propellers are manufactured outside of the United States air and hydraulic control valves, the motor driven oil pressure pump, and all electrical components are to be of standard United States manufacture in order to make replacement parts readily available.

The propellers shall have full pitch control both ahead and reverse. The pitch control shall be by means of pressure transmitted and controlled to and from the hub mechanism.

The oil distribution control system shall consist of

pressure pumps directly connected to power takeoffs from the main diesel engines, plus one standby motor driven electric pump and the necessary distribution boxes at the forward head of the gear train, collection and gravity oil tanks, and other necessary manifolds, strainers, filters, gauges, etc. The control system shall be set up so that the system actuating the pitch also controls the revolutions of the main propulsion diesel engines. The propellers shall be controlled from a station in the main engine room and also from the wheelhouse. Hydraulic air control valves shall take their supply from the ship's service air system. Positive means shall be provided for switching from the engine room to the pilot house with master switch controls located in the engine room. The control panel in the wheelhouse shall be incorporated into the stand as specified in Section 24 herein and shall include the shaft revolution indicating system instruments as specified in Section 65. Controls shall be of the handle type with the handle in vertical position for the zero pitch and pulled one way for ahead and the other for reverse. The propeller control stand shall include pitch indicator and engine speed control separate from the pitch control. A slave stand providing control

of both propellers shall be mounted on the starboard bridge wing and connected to the pilot house control through bronze chain and shafting. The pilot house stand shall also include a gauge to indicate the pressure of starting and control air.

SECTION 45 - LUBRICATING OIL SYSTEMS

Seven lubricating oil service systems are required, each independent, for the two main propulsion engines, three diesel driven generators, and the two reduction gears. In general these systems are self-contained except for the main engines where the lubricating oil coolers, filters, magnetic strainers, duplex strainers, etc., are mounted away from the engine proper. However there are no cross connecting services and the only connections are for filling, transfer and purifying. The general arrangement of the filling, transfer and stripping system and the service systems are to be generally as indicated in the contract plans subject to conformance with the manufacturer's requirements for his particular engines. The materials of piping are to be as shown in the contract plan. The piping layout is to be arranged for ease of servicing and repair and with as little interference of other systems and equipment as practicalbe. Pockets where oil or water can collect shall be kept to a minimum, and where such can not be avoided they will be fitted with drains or vents.

All steel pipes after fabrication and before installation shall be cleaned inside by pickling in hot acid, after which they shall

be washed, acid neutralized, dried, and coated with oil. All fittings of steel, cast, or malleable iron will be cleaned in a similar manner. After installation of the lubricating oil piping is completed the whole system is to be cleaned with circulating hot fresh oil through each system at not less than 140° F. for a continuous period of not less than 24 hours, and as much longer as necessary to get a clean system. During this time bypasses shall be fitted around all bearings and oil lubrication points. All strainers shall be fitted around all bearings and oil lubrication points. All strainers shall be fitted with fine mesh cloth bags and shall be changed often. A temporary pump should be used for this circulating.

The lubricating oil storage tank is to have a capacity of 350 gallons constructed of 1/4" steel plate shaped to the hull. Engine oil sludge tanks shall be of similar construction located for gravity flow from the lubricating oil sumps and of a capacity equal to the combined capacity of the various sumps. Means is to be provided by a hand stripping pump to discharge the dirty oil from the sludge tanks either into the fuel oil settling tank or to barrels on deck through a deck connection. A hand transfer pump is also required.

SECTION 47 - PUMPS

GENERAL

All pumps specified herein and as indicated on the contract plans are to be furnished and installed by the Contractor. They are to be highest commercial grade and generally equal to the makes specified below. The pumps are to be horizontal or vertical as shown on the contract machinery arrangement. Pump capacities and discharge heads are given below for guidance. However, final capacities are dependent upon the demands of associated equipment and on pressure losses of the final piping arrangements. Before making final selection of pumps the contractor is to check all associated equipment to insure that deliveries required for the service are met and is to assure himself that the discharge heads will be adequate to overcome pressure losses for the pipe sizes and arrangement of piping used.

Main pumps for salt water service shall have close grain cast iron casings with bronze impellers. Impellers are to be accurately machined and cleaned free of all dirt and are to be dynamically balanced. All shafts for salt water pumps shall be of steel with bronze liners or of Monel metal. If bronze liners are used on

steel shafts they shall fit tightly against the impeller and extend through stuffing boxes. All ball bearings are to be of ample size. Adequate means shall be provided to prevent water entering the bearings and motors. All units are to have vents on top of the casing and drains in the lower casing.

The following pumps shall be installed:

Bilge & Ballast Pump

The pump shall be "Worthington", Type PM, centrifugal with a capacity of 100 gallons/minute at approximately 35' head. The motor shall be approximately 3 horsepower turning 1750 rpm. The pump shall take suction from the bilge main, engine room bilge, the ballast main, and the sea, and shall discharge to the ballast main and overboard.

Fire and Washdown Pump

The pump shall be "Worthington", Type DNEF with a capacity of 170 gallons/minute at approximately 225 ft. The motor shall be 20 horsepower at 3500 rpm. The pump shall be located to afford a positive suction head or be self-priming. The pump takes suction from the sea and engine room bilge and discharges to the fire main and sea.

General Service Pump

The pump shall be "Worthington", Type PM.

Capacity shall be approximately 130 gallons/minute at 145' head.

The motor shall be approximately 7-1/2 horsepower turning 3500 rpm. The pump shall be self priming. The pump shall take suction from the

sea, bilge main, and ballast main, and shall discharge to the evaporators, the air conditioning refrigerator condenser, the cooler for the hydraulic system, and overboard.

Potable Water Pump

The pump shall be shallow well pump set similar or equal to "Jacuzzi" Series JX, complete with a 42 gallon galvanized pressure tank and automatic air control. The pump shall have a capacity of 18 gallons/minute at 60 lbs. pressure driven by a 1-1/2 horsepower 1750 rpm motor. The pump shall draw from the fresh water stowage tank and discharge to the fresh water pressure tank.

Salt Water Flushing Pump

The pump shall be "Jacuzzi" Series JX, shallow well pump, complete with 42 gallon galvanized pressure tank and automatic air control, with a capacity of 18 gallons/minute at 60 lbs. pressure driven by a 1-1/2 horsepower motor turning at 1750 rpm. The pump shall draw from the sea and discharge to the saltwater pressure tank.

Aquaria Pump

The aquaria pump shall be centrifugal "Worthington" Type DNG, having a capacity of 50 gallons/minute at a 25' head, driven by a 3/4 horsepower motor turning 3500 rpm. The pump shall

draw from the sea and discharge to the biological laboratory. The aquarium pump is to be constructed of high chrome, high nickle, low carbon stainless steel. The pump must be designed for chemical service and must be so designed and built that no parts other than stainless steel come in contact with the water.

Refrigeration Condenser Circulating Pump

The pump shall be centrifugal "Worthington" Type DNFE, having a capacity of approximately 15 gallons/minute at a 35' head, driven by a 1/2 horsepower motor at 1750 rpm. The pump shall draw from the sea and the forepeak bilge and discharge to the refrigerating condenser and overboard.

Diesel Oil Transfer Pump

The pump shall be rotary positive displacement type "Worthington Type GR, having a capacity of 37 gallons/minute at 15 lbs./square inch discharge pressure. The pump shall be driven by a 1 horsepower motor at 1200 rpm and shall take suction from the diesel oil tanks and the deck filling line and shall discharge the diesel oil tanks and the deck.

Sewage Disposal Pump

The pump shall be "Aurora", Type KCM, non-clogging

type, having a capacity of 35 gallons/minute at 23' head, driven by a 3/4 horsepower motor turning at 1150 rpm. The pump shall be float controlled and draw from the sewage tank and discharge over-board.

Lubricating Oil Stripping & Transfer Pumps

The pumps (two) shall be hand type "Blackmer" or equal, semi-rotary type drawing from engine sumps, lube oil drain tank, and discharging to the engine lube oil system, lube oil drain tank and deck.

Fresh Water Circulating Pump for Air Conditioner

The pump shall be centrifugal "Worthington" Type DNFE, having an approximate capacity of 20 gallons/minute at 20' head, driven by a 3/4 horsepower 1750 rpm pump.

In addition to the pumps specified above, hydraulic pumps for the topping lift winch hydraulic package, and for the propeller pitch control system shall be furnished as specified elsewhere herein.

SECTION 48 - PIPING

GENERAL

The Contractor is to furnish and install all piping systems as required for satisfactory operation of the equipment furnished and in accordance with the contract piping diagrams. All piping is to be of materials as specified on the contract plans to the approval of the U. S. Coast Guard and the American Bureau of Shipping. Pipe sizes shown on the piping diagrams shall be provided for guidance but in cases of cooling water piping, etc., sizes must be checked against required capacities and flow rates of the equipment furnished and to meet the pressure heads of the pumps selected.

Design and installation of the piping systems shall be in accordance with best marine practice. The lines are to be direct with as few bends and elbows as practicable, allowing for expansion. American standard flanges and fittings are to be used throughout. All piping systems are to be laid out for easy access. Clean-out plugs shall be installed in all drain lines and drain plugs elsewhere in all systems to allow draining of the systems.

All piping must fit without springing or forcing into place. Flange faces must fit parallel before bolting.

Where piping is below the engine room floor plate the valve stem shall be vertical with hand wheels below the floor plates with removeable sections of plating over the handwheel. Where valves are located in accessible positions and where American Bureau of Shipping or Coast Guard rules require it, extension stems on operating gear shall be installed. Operating gear may be cold rolled shafting or galvanized pipe with cut bronze bevel gears or "Brooks" type universal joints. Indicators shall be installed in all remote operating handwheels or deck plates and attachment to valves will be by forks or sockets pinned to the valve stems.

Relief valves shall be installed on the discharge side of all positive displacement pumps and the discharge side of the fire and sprinkling pumps if the shut-off pressure exceeds 125 lbs. Relief valve discharges on all water lines shall be to the bilge and other lines to the suction side of the pumps.

All valves shall be "Crane", "Walworth", or approved equal, marine type, with pressure rating suitable to the service.

Pipes shall be cut by a square nosed tool and inside burrs removed. All piping systems shall be installed clean and after installation shall be blown with an air blast to remove all foreign matter. For cleaning of lube oil and hydraulic piping see Section 45 of this specification.

Chill or backing rings shall be used in all butt welded pipe joints except for joints which are accessible on the inside for inspection and removal of slag and welding spatter. Flanges or unions must be furnished for take down. All unions are to be ground joint. Pipe flanges or unions adjacent to electrical equipment shall be provided with shields to protect the equipment. All hose fittings throughout the ship shall be standard pipe thread (IPS).

Overhead piping run under the deck head throughout the quarters spaces shall generally be concealed. The layout and run of pipe shall be coordinated with ventilating ducts and wireways. Vertical pipe leads through the main deck and lower deck quarters shall insofar as practicable be run in lockers or toilet spaces and not be exposed in passageways or staterooms. Piercing of web beams or girders must be done near the neutral axis and compensation provided as required by the American Bureau of Shipping.

Piping shall be securely supported and braced to prevent damage by vibration, with allowance for expansion, using specially designed hangers where necessary. The pipe hangers shall be shaped to 1/2 of the pipe and secured by a mating clamp. All hangers shall meet U. S. Public Health Service ratproofing requirements. Additional pipe hangers shall be furnished and installed by the Contractor at the direction of the Owners' representatives if necessary to eliminate vibration in piping discovered on trials.

Main and emergency sea chests in the engine room are to be built as part of the ship's structure. These sea chests shall be fitted with steel strainer plates having 1/2" x 4" slots in the face with a total area of not less than three times the area of the suction pipe. The sea chests for the aquaria shall be entirely constructed of stainless steel with a 1/4" stainless steel strainer plate, and 1/4" x 2" slotted holes having a total area three times the size of the suction sea valve. All strainer plates shall be secured flush with the shell plating by light tack welds. Each sea chest is to be fitted with compressed air blowdown lines and the engine room sea chests are to have a 1" vent line leading just under

the main deck. Main sea chest shall have a return bleed line from the engine cooling water discharge.

The main and emergency sea valves shall be galvanized steel or bronze, flanged and bolted directly to the sea chests and shall be of the high lift angle valve type. Aquaria sea valve shall be high nickel stainless steel.

All overboard discharge valves are to be cast steel bronze trim or all bronze, flanged and bolted to the overboard discharge fittings. They may be globe, gate, or angle type as best suited to the piping. Handwheels are to be easily accessible from floor plates. Where bronze valves are fitted to the overboard discharge a waster piece shall be installed. The design of the waster piece shall be so that corrosional water will not impair the strength of the sea connection. Scupper valves for plumbing and deck drains are to be swing check type with cast steel bodies and bronze pins for the flappers.

Sectional brass sounding rods shall be provided, one for fuel oil, one for water, and one for lube oil tanks. Rods shall be graduated in feet and inches.

Equalizing valves on center line bulkhead of oil and

water tanks are to be sized to meet Coast Guard rules for equalizing tanks in fifteen minutes.

The following piping systems shall be installed of the materials, and to provide services as indicated on the contract plans, and as specified elsewhere herein:

- (1) Bilge and ballast system
- (2) Fire and wash down system
- (3) Sanitary water system
- (4) Fresh water system (including distiller)
- (5) Engine room fresh and salt cooling water system
- (6) Sounding tube, vent and overflows
- (7) Plumbing and deck drains and sewage disposal system
- (8) Aquaria system
- (9) Air system (See Section 49)
- (10) Exhaust system (See Section 52)
- (11) Hydraulic system
- (12) Lubricating Oil system (See Section 45)
- (13) Fuel Oil System (See Section 55)

SEWAGE DISPOSAL SYSTEM

In order to prevent contamination of water samples by

overboard discharges, all discharges except minor circulating water as shown on the contract piping diagrams are to be kept completely away from the port side of the vessel. This has required the collection of the majority of the pumbing drains into a 100 gallon sewage disposal tank located in the engine room. The tank is to be constructed of 1/4" steel plate, vented, fitted with manholes, and with necessary pipe connections. Drains shall be collected into the tank and shall be discharged overboard by the sewage disposal pump. The pump shall be actuated by a mechanical control, and is to be fitted with a high level alarm.

SECTION 49 - COMPRESSED AIR SYSTEM

GENERAL

The compressed air system shall be installed of materials and connections as shown on the contract plans. Operating air pressure as indicated on the contract plan is 250 lbs., but the actual pressured used shall be that required by the engines selected. Starting air receivers shall be of steel to U. S. Coast Guard and American Bureau of Shipping standards for construction and capacities shall be such that each tank will provide six complete starts for each main engine without replenishment. Engine mounted air compressors are to have sufficient capacity so that each compressor can recharge one starting air tank with a minimum of one hour time. Emergency air compressors shall be air-cooled, motor driven "Worthington" Type C, two stage Model 3C2, having a capacity of 7-1/2 cu. ft. /minute of free air against a 250 lb. discharge pressure. One 5 cu. ft. service air receiver shall be installed charged through a reducing valve and with connections taken to a sea chest blow-out, 2-1/2" connections with air hose valves adjacent to the workbench in the lazarette, to the whistle, and to the air control system for the engines and propellers.

Two 25' lengths of 1/2" air hose complete with stowage racks fitted with valve and tire inflation units at one end and a quick coupling air hose connected on the other to match the valves near the engine room work benches shall be provided and stowed in the main engine room and lazarette as directed. One connection shall be taken from the ship's service air line to the air conditioning control system and be fitted with dryers and separators as required by the control manufacturer.

A 1/4" connection with a short length of hose is to be installed adjacent to pressure tanks for discharging the fresh water and salt water pressure tanks. Ends of the hose are to have the fitting for temporary connection to a tire valve on each tank. The tire valve must be incapable of permanent connection and must be held on by hand.

WHISTLE

The Contractor is to furnish and install one "Cunningham" Model 3-AS air whistle complete with whistle control valve located on top of the pilot house. The whistle control shall be manual, consisting of bronze braided cable spring tensioned and led through

brass fittings over bronze sheaves. The cable shall extend from the whistle and be led port and starboard and dead ended against the outboard ends of the pilot house or just under the deck head. A manual pull on the cable will actuate the whistle. Whistle air lines are to be led as directly as possible to the whistle and all pockets where water can collect are to be avoided.

SECTION 51 - BOILERS AND HEATING SYSTEM

A heating system is to be installed complete with convectors, unit heaters, and coils in the ventilating ducts all as indicated in the contract ventilation diagram. Hot water for the heating system shall be provided by a Contractor installed hot water heater. The heating boiler shall be similar or equal to "Way Wollf" ship heater size 3630-10E having an output capacity of 250,000 BTUs per hour. The heating boiler shall be complete and self-contained with all necessary automatic controls for burning standard diesel oil. The installation shall be complete and in full accordance with U. S. Coast Guard regulations.

SECTION 55 - FUEL OIL SYSTEM

Diesel oil shall be stowed board in bunker tanks arranged as indicated on the contract plans. A single system is provided to serve the main engines, generators and the heating boiler. Filling connections shall be fitted at the stern designed to fill all fuel oil tanks by gravity or through the fuel oil transfer pump. Fuel oil transfer and service system shall be installed complete as indicated in the contract plans. Settling tanks shall have high and low suctions connected to the lube oil stripping system for discharging water from the settling tank. The settling tank is to be fitted with a remote reading liquidometer level gauge.

Emergency generator fuel oil system shall be self-contained with a tank sized to meet Coast Guard requirements for 12 hour operation, located at the generator. Tank is to be filled by hand from cans filled in the engine room from the settling tank through the hand lubricating oil stripping pump.

SECTION 58 - DISTILLING PLANT

The Contractor shall furnish and install in the engine room two complete distilling plants of the packaged type, similar or equal to "Maxim VJ-20" as manufactured by the American Machine and Foundry Co. Each plant shall have a capacity of evaporating and distilling 750 gallons of fresh water per day when supplied with jacket water from the main propulsion diesel engines. Each plant shall be capable of developing full capacity when receiving water from one main diesel engine with the engine developing any increment of power between 200 and 400 brake horsepower. No cross connections between engines will be provided.

A solenoid operated valve shall be installed in the discharge line from each plant operated from the salinity indicating system. One outlet port of this valve shall connect with the potable water system, and the other outlet shall connect by a funnel to the bilge. A salinometer set under Military Specification MIL-S-1186 shall be provided. Drain, vent and other piping shall be installed as necessary for the installation. The salinity indicator system shall be provided as part of the plant as required by the electrical specifications herein.

SECTION 59 - REFRIGERATION PLANTS

SCOPE

The Contractor shall furnish, install, test, and prove in operating condition two refrigerating plants; one as required for the zero degree ship's freezer, the bait stowage space forward, and the 38⁰ ship cooler space forward; one as required for chilling water and providing the chilled water to the coils in the air conditioning system.

SHIP STORAGE & BAIT STORAGE REFRIGERATION PLANT

The Contractor shall furnish and install a Type 1, Class 1, refrigeration system complete, fully in accordance with specification MIL-R-16743 (e). The refrigeration compressors and condensers shall be located under the forecastle head where shown and shall be properly piped up to the cooling coils in the zero degree spaces and to the unit cooler in the ship's cooler space. Compressors shall be two freon (F 12) units, each having a capacity of one ton of refrigeration effect at a saturated vapor temperature of minus 10⁰ F. Suction from the cooler space shall be through a back pressure regulator. The system shall be manifolded so that either

or both compressors can be placed on any or all of the three spaces. Two speed motors and controls shall be provided for the compressors. Refrigeration condensers shall be water cooled and be served by the refrigerating condenser circulating pump specified in Section 47 herein.

Cooling coils in the freezer space shall be bare pipe, hairpin type, sized on the basis of a heat transfer rate of not to exceed 1.75 BTUs/square foot per degree temperature difference. For the purpose of sizing the coils the heat loss in the ship's freezer space shall be figured at 7200 BTUs and in the bait storage space at 9500 BTUs, and the operation cycle shall not exceed 16 hours.

The unit cooler for the ship's cooler space shall be a standard commercial unit "Carrier", or equal, designed to maintain 38^o coil temperature and with a heat loss of 3600 BTUs/hour in the compartment. The unit shall also have a capacity of 50% in excess of this net requirement in order to allow a cycle of 2/3 on and 1/3 off. The coils in the unit cooler shall be of copper and all ferrous parts shall be galvanized. The unit cooler fan shall be thermostatically controlled to maintain 38^o in the compartment. The cooling unit coils shall be provided with a drip pan properly piped to the floor.

The coils in the zero degree compartments shall be

located on the sides only throughout the entire periphery of the rooms, and shall be banked as required for adequate capacity.

Coils shall be not less than 1-1/4" bare copper.

Variable capacity control of the compressors will not be required. A "Hallide" leak detector will not be required. Details of equipment installation, piping and control, shall all be in accordance with the Military Specification. Hot draft defrosting will be required.

AIR CONDITIONING REFRIGERATION PLANT

The Contractor shall furnish and install a Type II, Class I, refrigeration system complete and fully in accordance with specification MIL-R-16743 (e). Compressors and water chiller shall have a capacity of not less than 15 tons and shall be capable of removing heat loads from coils as shown on the contract diagram.

Compressor, condenser, chiller, and circulating pump shall be located in the machinery space where indicated. Coils and unit coolers shall be as designated on the diagram. Variable capacity control of compressors will not be required. Condensers shall be water cooled, serviced by the pump specified in Section 47 herein.

Temperature of entering water to the coils shall be 45^o. A "Hallide" leak detector will not be required.

Details of equipment installation, piping and controls shall be in accordance with the contract diagram and the military specification.

QUALIFICATION & SHOCK TESTS

Prequalification tests required by the Military Specification will be waived providing compressor units are standard commercial units of recognized manufacturers and can be demonstrated to have performed satisfactorily in the marine field. Shock-proof requirements will also be waived.

SECTION 60 - ELECTRICAL PLANT

GENERAL

Electrical power shall be supplied from a conventional 450/120 volt, 3-phase, AC system.

Three 60 KW, 450 volt, 3-phase, 60 cycles, AC Diesel generators, located in the engine room shall supply the primary electrical power which is used for all motor driven auxiliaries (except a few fractional horsepower units which are supplied with 120 volt, single phase). Power for lighting and communication systems is obtained from a bank of transformers located in the engine room.

Direct current requirements for starting Ships Service and Emergency Diesel generators and for the general alarm, shall be supplied by batteries described in sections below.

Emergency electrical power shall be provided by a 5 KW, 120 volt, 3-phase, 60 cycle Diesel generator set which is located on Upper Deck, Aft. The emergency load is limited to vital lighting and communication circuits.

A 450 volt, 3-phase, 100 amp shore connection box or receptacle shall be provided on Main Deck, Starboard, Frame 20, to receive electrical power when the vessel is tied to shore installations.

The design of the electrical installation shall be in accordance with the applicable sections of the U. S. COAST GUARD ELECTRICAL ENGINEERING REGULATIONS CG-259 of 1 DEC. 1960 and AIEE #45, RECOMMENDED PRACTICE FOR ELECTRICAL INSTALLATIONS ON SHIPBOARD.

The elementary wiring diagrams and deck plans of the various systems contain lists of recommended equipment, fixtures and wiring appliances. The lists are not restrictive as to equipment or manufacturer; however, all equipment shall meet U. S. Coast Guard requirements. Motor and cable sizes indicated are approximate only and final sizes are to be based on the actual loads involved.

SECTION 61 - MAIN AND EMERGENCY GENERATORS

The three diesel driven generators shall be rated 60 KW, 0.8 P.F., 450 volts, 3-phase, 60 cycles each. They will be required to operate in parallel and shall have adjustable voltage droop. Starting of the Diesel engines shall be from a bank of three, 8-volt trays of batteries connected in series for a nominal voltage of 24 volts. This battery shall have a minimum capacity of 284 ampere hours at an 8-hour rate and shall be able to start successively the three generators. Charging current for the batteries shall be supplied from charging panels attached and furnished with each generator. Each charging circuit shall be equipped with a normally open relay to isolate idle generators. A diagram of this circuit is shown on plan 2178-S62-2. The bank of batteries shall be located on the starboard side of the engine room in back of the generator and distribution switchboard, as shown on Arrangement Plans.

One emergency Diesel generator 5 KW, 0.8 P.F., 120 volt, 3-phase, shall be installed in a deck house on the upper deck aft. It shall be battery started and have generator control and bus transfer equipment mounted on a panel in the deck house. Upon failure of the ships service lighting system, the unit shall automatically start and

pick up the emergency portion of the lighting system load; local pushbutton start shall also be provided at the unit. The set shall furnish 120 volt, 3-phase, AC power to two power panels which supply emergency lighting and communication loads. These panels are normally to be supplied from the ship's service switchboard through the bus transfer equipment. Starting batteries for emergency diesel generator shall be two six volt, 168 ampere hour, equal to "Willard" Type HDD-SD, located in a suitable container in the generator enclosure.

DIESEL ENGINES FOR GENERATOR SETS

The prime movers for the 60 KW diesel generator sets are to be "Caterpillar" Model D-330, or equal. Engine speed is not to exceed 1800 rpm. Piston speed is not to exceed 1800 ft. per minute. Brake mean effective pressure for four cycle turbo charged engines is not to exceed 130; for two cycle and for naturally aspirated four cycle engines the BMEP is not to exceed 85. Engine and generator sets are to be complete integrated packaged units, which can be set in place without further internal alignment by the Contractor. The engines are to be mounted on suitable vibration isolators furnished by the engine manufacturers and suitable for the mass and natural frequencies of the units. Engine mounts are to be suitable for the conditions of roll and

pitch encountered in marine service, and collision chocks are to be installed to prevent the engines breaking loose from the mounts in the event of a crash stop. Engines are to be water cooled with fresh jacket water, in turn cooled by salt seawater. Engine equipment attachments are all to be suitable for marine service.

The emergency diesel generator shall be 1800 RPM, a packaged unit, air cooled, with piston speeds and brake mean effective pressure limitations as specified for the main diesel generators. The emergency generator shall also be mounted on factory furnished vibration mounts and shall be a complete, self-contained unit. Units are to be similar or equal to Onan Model 5 DRP.

Emergency generator is to be enclosed in a 12 gauge steel enclosure providing weather protection and air circulation for cooling.

SECTION 62 - POWER & LIGHTING DISTRIBUTION

The switchboard is located in the engine room adjacent to the Diesel generators on the starboard side. It

consists of five units.

1. Generator #1 Switchboard
2. Generator #2 Switchboard
3. Generator #3 Switchboard
4. 450 V Power Distribution Switchboard
5. 120 V Power Distribution Switchboard.

The units shall be mounted on a common base and secured to a platform. Horizontal top bracings shall be provided which possess inherent flexibility. The units shall be of dead front construction and in all respects conform to paragraph 111.35 of CG-259. The height of the switchboards shall be limited to 74 inches over all including foundation and drip shields.

The Electrical System Elementary Diagram, Plan 2178-S62-1, shows the arrangement of the switchboards and one line bussing diagram. Two 450 volt distribution busses are shown; one for general ship's service power, and the other for the trawl winch. It shall be possible to energize the busses separately or together, depending on existing load conditions. Disconnect switches (circuit breakers without trip elements) shall be provided for paralleling and selection of generators and busses. Number, sizes

and types of distribution circuit breakers are shown in the elementary diagram.

A bank of three 7.5 KVA, single phase, 60 cycle, transformers connected in Delta/Delta, shall be provided to energize the 120 volt power distribution bus.

A 100 amp circuit breaker with overload protection shall be connected to the power distribution bus to receive shore power.

DISTRIBUTION PANELS

Power and lighting distribution panels are located in passages and areas throughout the ship. 450 volt power panels shall have 100 amp 3-phase breakers with interchangeable inverse time delay and short circuit overload trip elements, except as otherwise noted. 120 volt power and lighting panels shall have 50 amp breakers with interchangeable inverse time delay and short circuit overload trip elements. The 120 volt panels are 3-phase bus, single phase branches, except panel #1-22-3 which has 3-phase branches and supplies the test panels for the various scientific laboratories. Plan 2178-S62-1 shows the diagrammatic arrangement of the panels and the phase distribution for 120 volt single

phase branches. All panels shall be of dead front construction, drip-proof, with doors, except the two in the engine room, which require no doors.

A magnetic contactor shall be connected to the ventilation power feeder and located adjacent to Panel 01-22-1. When energized the contactor shall shut off power to the panel. The contactor shall be operated by a pushbutton located in the pilot house.

LABORATORY TEST PANELS

The chemical and the biological laboratory and the scientific information center shall be provided with a test panel containing the services and equipment shown in the elementary diagram on plan 2178-S62-3. The test panel in the hydrographic laboratory is shown for future installation and shall not be provided by this contract.

The panels shall be of dead front construction, open, for bulkhead mounting. The following appurtenances shall be mounted on each panel:

One 450 volt 3-phase 100 amp circuit breaker with 15 amp overload protection

One 120 volt 3-phase 50 amp circuit breaker with 15 amp overload protection

Two volt meters and volt meter switches, voltages as shown;
similar to Weston Model 924

One 1KVA, ratio 1:1, single phase isolation transformer

One 1KVA, 0-460 volt single phase auto-transformer, Superior
Electric Co., or equal

One frequency meter 56-64 cycles, 125 volts, similar to Weston
Model 927

30 connectors, 450 volt, 30 amp for mounting on metal panel
similar to Superior Electric Co. Bulletin BP958

30 test prod cables, 8 feet long, similar to Belden 8898, except
#16 AWG. One end shall be fitted with a banana plug suitable
for above connector.

CABLE

Commercial type AVI (asbestos-varnished cambric,
impervious sheathed, and armored) cable shall be used for all
power and lighting circuits. Type VI cable (without asbestos) may
be used in interior spaces, except in machinery spaces. Type RI
(rubber insulated) cable may be used when allowed by CG-259.
Navy type HFA cable may be substituted when calculated for 50°
ambient. Cables in exterior locations exposed to weather shall
have bronze armor. Portable cables shall have a ground conductor;
the housings of equipment attached to the portable cables shall be
type ICI (interior communication, impervious sheathed and armoured).

Navy type cable, Type HFA, may be substituted. Electronic cable shall be as recommended by the manufacturers.

Cable runs shall be as direct as possible. Maximum use shall be made of cableways, which shall be developed from the power, lighting and I. C. deck plans.

Maximum use shall be made of four-conductor cables (FAVI-4) on lighting plans in order to save space and weight.

All cables shall be tagged where they enter or leave insulation, sheathing, or furred spaces, or otherwise pass out of sight. They shall be tagged where they pass through decks and bulkheads, and where they enter equipment.

SECTION 63 - MOTORS AND CONTROLLERS

Equipment shall be in accordance with applicable sections of CG-259. Particular attention is invited to the requirement for disconnect switches. Controllers are LVP (low voltage protection) or LVR (low voltage release) as indicated on plans 2178-S62-1, 2, & 3.

Motors and controllers in engine room and wet spaces shall be watertight or drip-proof protected. Motors located below floor plates shall be watertight or have openings for ventilation above the floor plate level. Pushbutton stations, which have not been indicated or remotely located on deck plans, shall be located in controller housing. Remotely located pushbuttons shall have watertight enclosures.

SECTION 64 - LIGHTING SYSTEM

GENERAL LIGHTING

The lighting system has been designed in accordance with the needs peculiar to the mission of the vessel. The laboratories and wardroom have been equipped with fluorescent fixtures to provide 100 foot candles at table top level. The open decks shall be provided with a floodlighting system to enable night operations. Staterooms shall have overhead, mirror and bunk lights, as well as a convenience receptacle. The mirror and bunk lights are 15 watt fluorescent type. Storerooms and working spaces have conventional incandescent fixtures. Ceiling fixtures in passages, living spaces, and laboratories are to be recessed. All fixtures shall have U. S. Coast Guard approval. Three-way switches shall be provided where shown to control passage and stairway lights. All switches except three-way and those mounted on equipment are to be double pole; type of enclosures are shown on plans.

All receptacles shall be of the grounding type. Interior receptacles for 120 volt, single phase shall be NEMA 2 pole, 3 wire parallel blade type. Exterior receptacles shall be angle type. Contractor shall furnish one matching plug for each exterior receptacle.

RUNNING, ANCHOR AND SIGNAL LIGHTS

This system has been designed to meet the requirements of the international rules listed in "Pilot Rules, CG 169, U. S. Coast Guard of 1 April 1958". In addition to conventional running lights, the following lights, peculiar to the mission of the vessel, have been added: trawling, survey, fishing, and net lights. Receptacles shall be angle type, waterproof, single gang, three wire, four pole. Plugs matching the receptacles shall be provided.

The navigation light panel is located in the pilot house. It shall be non-automatic for double filament lamps. The elementary wiring diagram on plan 2178-S64-3 shows the connection of a typical circuit.

SECTION 65 - INTERIOR COMMUNICATIONS

GENERAL

The following I. C. Systems shall be installed:

	<u>System</u>	<u>Circuit</u>	<u>Panel</u>	<u>Branch</u>
1.	General Alarm	G	Battery Powered	
2.	Telephone	EM	Self-energized	
3.	Sound Power Telephone, Scientific	J	Self-energized	
4.	Rudder Angle Indicating	N	I. C. Panel 2-24-4	5LE-1A
5.	Shaft Revolution Indicating	K	I. C. Panel 2-24-4	5LE-1G
6.	Salinity Indicating	SB	I. C. Panel 2-24-4	5LE-1E
7.	Lub. Oil & Circulating Water Alarm	EC	I. C. Panel 2-24-4	5LE-1B
8.	Call Bell	E	Panel 01-23-1	8L-1
9.	Instrumentation Cable	IN	Not energized	
10.	Announcing	MC	Panel 01-23-2	7LE-2
11.	Steering Control	LCS	I. C. Panel 2-24-4	5LE-1D
12.	Wind Direction and Intensity Ind. Sys.	HD&HE	Panel 01-23-2	
13.	Gyro Compass System	LC	Panel 01-23-2	

Elementary diagrams with lists of equipment for the I. C. Systems are shown on Plan 2178-S65-1, and the cabling is shown on Plans 2178-S65-2 and 2178-S65-3.

GENERAL ALARM, CIRCUIT "G"

This system is supplied from a 24 volt, 40 AH battery located under ladder on upper deck, frame 21, port. The charger is located adjacent to the battery and is connected to emergency lighting circuit 8-LE-2. The contact maker and the fuse panel are located in the pilot house. General alarm bells are divided into three groups of three bells each. The bells are distributed in all parts of the vessel in deck passages, wardroom, forward and aft deck, engine room and steering room. The system shall be in accordance with the latest directives of the U. S. Coast Guard.

TELEPHONE SYSTEM, CIRCUIT "EM"

This system consists of eight stations which are located as follows:

1. Pilot House
2. Engine Room
3. Steering Room
4. Spare
5. Scientific Information Center (SIC)
6. Main Deck, Passage (Laboratories)
7. Chief Engineer
8. Wardroom.

The telephone stations are to be selective ringing common talking units, each with a selector switch, a sound power telephone, a hand cranked ringer generator, and a bell. This is a dual system in that the pilot house, engine and steering room are the ship's operating circuit which, in emergency, can be isolated from the administrative circuit formed by the remainder of the stations. A rotary transfer switch to separate or connect the two systems shall be located in the pilot house.

SOUND POWER TELEPHONES, SCIENTIFIC, CIRCUIT "J"

The purpose of this system is to relay information between stations occupied by scientific personnel during tests and oceanographic experiments. The stations are:

1. Pilot House
2. Trawl Winch, Main Deck
3. Bow Observation Chamber
4. Scientific Information Center (SIC)
5. Winch Control Station, Aft
6. Aft Mast Platform.

Jack boxes and cable shall be installed. Sound power telephones will be furnished by the Contractor. These shall have standard Navy type headsets. Headset stowage boxes will be provided for each headset.

RUDDER ANGLE INDICATING SYSTEM, CIRCUIT "N"

This system consists of a self-synchronous transmitter attached to the rudder in the steering room and two indicators in the pilot house. One indicator shall be mounted midship above the steering stand and the other on the starboard bridge wing to facilitate docking operations. The scale of the indicators shall be 35° port and starboard.

SHAFT REVOLUTION INDICATOR SYSTEM, CIRCUIT "K"

This system consists of two self-synchronous transmitters attached to the two propeller shafts in the engine room, two indicators at the engine room control stand, and two indicators above the steering stand in the pilot house. The indicators shall have a scale of 400 RPM.

SALINITY INDICATOR SYSTEM, CIRCUIT "SB"

This system shall consist of a control panel, an alarm horn, two salinity cells and automatic dumping valves. The panel shall present visual indication of high salinity.

LUBE OIL & CIRCULATING WATER ALARM SYSTEM, CIRCUIT "EC"

This system monitors lubricating oil pressures and circulating water temperatures of the two propulsion Diesel engines and the three Diesel generators. Pressure and temperature sensing contactors shall be installed in lubricating oil and cooling water pipe lines and connected to a panel which shall be equipped with red indicating lights and an adjacent siren. Indicating lights shall also be installed in the pilot house; a green light to indicate that the system is energized, and a red light to report an abnormal condition. The red light shall be of the "Push to Test" type.

CALL BELL SYSTEM, CIRCUIT "E"

This is a companion circuit to the Sound Power Telephone, Scientific, Circuit "J", to enable the bow observation chamber to establish contact with SIC and the pilot house and vice versa when the S. P. telephones at these stations are not manned. Two buzzers and pushbuttons are installed in the bow observation chamber and one set of buzzers and pushbuttons each in the pilot house and SIC. The system is energized from a 120 volt single phase receptacle circuit in the pilot house.

INSTRUMENTATION CABLE, CIRCUIT "IN"

This circuit consists of a 6-pair shielded cable (TTRS-6), which is permanently installed between SIC and Chemical Laboratory and between SIC and the platform on the after mast. It enables scientific personnel to connect transducers and other sensing devices with the instruments located in the laboratories. The cable shall be of unarmored construction. End connections shall consist of watertight plug and receptacle (for 6-pair cable) at the platform and terminal boards in SIC and Chemical Laboratory.

ANNOUNCING SYSTEM, CIRCUIT "MC"

This system shall provide a means for general announcing throughout the ship. The installation shall consist of power supply, amplifier, and relay assemblies in the radio room, a speaker-microphone, paging and voice selector cabinet in the pilot house and eight sound reproducers located in passages, ward-room, engine room and on open decks. A volume control shall be installed in the voice selector assembly; each reproducer shall have a four-tap volume adjustment. It shall be possible to select any station or stations for announcement. Equipment locations shall be

as shown on plans.

STEERING CONTROL SYSTEM, CIRCUIT "LCS"

This system shall consist of a gyro-pilot steering stand located in the pilot house which transmits signals to the steering engine motor controller and the hydraulic unit located in the steering gear room when a change of course is desired. The steering stand shall also provide means to transfer from the main steering unit to an auxiliary unit. It shall be equipped for automatic and hand steering. Cabling to be as shown on electrical plan.

WIND DIRECTION & SPEED INDICATOR SYSTEMS, Circuit "HD&HE"

This system shall consist of Navy type B equipment; one wind direction and speed detector on the forward mast, a master transmitter and a direction and speed indicator in the Scientific Information Center. The detector shall be located in an unobstructed place on the foremast. 110 volt single phase power shall be obtained from Panel 01-23-2 in the radio room and shall be connected to the master transmitter. The detector, master transmitter, and indicator shall be Owner furnished. Contractor shall supply cable required (10 conductor IC cable) and install and connect the system.

GYRO-COMPASS SYSTEM, CIRCUIT "LC"

This system shall consist of:

- (1) One Sperry Piedmont Co. "Mark 14", Mod. 2 master gyro compass complete with motor generator, control and amplifier panels, voltage regulator and alarm unit.
- (2) Two column mounting bearing repeaters.
- (3) One steering repeater.
- (4) One repeater switch panel with four switches - one switch to serve each repeater, one switch to service the gyro pilot, and one spare.

The master compass and associated equipment and the repeater switch panel shall be located in the radio room. Two column mounting repeaters shall be installed one on port and one on starboard bridge wings. The steering repeater shall be bulkhead mounted in the pilot house on the outer line. (The gyro pilot is located in the pilot house--See Ckt. "LCS").

The motor generator unit shall receive 440 3 Ø 60 cycle power through an enclosed 3 pole, 100 amp circuit breaker attached to Panel 2-24-2 in the engine room.

The master compass and equipment and column mounting repeater shall be Owner furnished. The Contractor shall provide

the repeater seitch panel and all cable. He shall install and place
in operation all cable and equipment required for the system.

SECTION 66 - SEARCHLIGHT

A 12" searchlight shall be installed on top of the pilot house, one foot on port side off centerline and 36" aft of forward edge of the pilot house. It shall be a pedestal type with minimum height above deck of 48" and with pilot house control, similar to Crouse-Hinds Co. Type DCX-12 Catalog No. 44282-A, with mogul screw lamp 500 watt.

SECTION 67 - ELECTRONIC EQUIPMENT

This equipment complete will be furnished by the Owner and will consist of radar, Loran, depth finders, and radio transmitters and receivers. These equipments, including external wiring, shall be installed in accordance with the manufacturer's specifications. Power for these equipments shall be obtained from the emergency power panel 01-23-2 located in the radio room.

Types and locations will be as follows:

- (1) Radar. Owners will furnish a Sperry "Mark 3" radar set consisting of an indicator and transceiver for mounting in the pilot house; a scanner to be mounted on top of the pilot house, and wave guide materials.
- (2) Loran. Owners will furnish one Sperry "Mark 2" Mod. 2, Loran set consisting of an antennae coupler, power supply unit and receiver-indicator for mounting in the Scientific Information Center.

Contractor will supply an isolation transformer "Sperry" or equal, and a vertical wire antennae between the triatic stay and house top complete with lead-in fittings, insulators, etc.

- (3) Edo, Sonar Sounding Set. This equipment will be Type An/UQN -1B Navy Stock No. F-5845-699-4005 or F5845-682-9704. It will be installed in the Scientific Information Center. Transducers (2) will be located in the hold at about Frame 18.
- (4) Simrad Depth Finder. This equipment will be located in the pilot house, with transducer at Frame 18.
- (5) Radio Transmitters & Receivers. The Owners will furnish the

equipment listed below and the Contractor will install it in working order. Installation shall comply with U. S. Coast Guard regulations and F.C.C. regulations referenced therein.

- (a) One "Northwest" Model NW-3-HST and companion unit, 250 watt, 10 channel, radio telephone.
- (b) One emergency radio telephone, "RCA" Model ET-8060 or ET 8012D, 75 watts.
- (c) One "Northern" or equal radio telephone, 388C, 25 watt transmitter, 5 channel.
- (d) One ELDICO, S-100 single side band, 100 watt, 4 channel.
- (e) Two Model HRO-60 Receivers.
- (f) Radio voice suppression filters for installation on input supply fenders.
- (g) One each, auto alarm and alarm signal keyer.
- (h) One Ship's Call Alarm.

The Contractor shall provide all interconnecting wiring and the following radio antennae:

- (1) One main antennae
- (2) One emergency antennae
- (3) Two whip antennae. (deck mounted).

Main antennae shall lead between top masts and be of 1 x 19 phosphor bronze wire, 22 gr./strand.

Antennae installation shall be complete with suitable lead-ins, lead-in insulators, safety links, trunks, switches and accessories.

- (6) Temperature and Conductivity Meter. This equipment will consist of one "Foxboro" or equal two pin recorder in a 12" rectangular case suitable for operation on 115 volt, 60 cycle current. Two 1/8" O.D. stainless steel capillaries will be supplied with the equipment. Contractor is to install the equipment in the Scientific Information Center and run the capillaries to the hold and connect to the sea chest for the intake of water to the aquaria system.

SECTION 68 - CATHODIC PROTECTION SYSTEM

The Contractor shall furnish and install a complete and operable cathodic protection system for the salt water services in the vessel. This shall be as built by the Consolidated Electric Corporation, 3201 First Avenue South, Seattle, Washington, and shall consist of an electrolytic control console to be located in the engine room, a rectifier or motor generator set, and anodes to be located in the salt water system at each end of the fresh water coolers for the main engines. A salt water treatment tank shall be constructed of 5/16" steel plate of size and shape generally as indicated on the machinery arrangement plan. All salt water service suctions with the exception of the line to the aquaria pump are to be led through this service tank. The tank will be fitted with a clear opening at the center of the top with a bolted plate cover and rubber gasket to make a watertight seal. The bolted plate cover shall be laid out to take the anodes. Cables shall be led from the electrically controlled console to the anodes in the tank and to stations throughout the salt water piping on the vessel.

SECTION 68 - continued

ALTERNATE

The bidding documents require the Contractor to quote a separate price for deletion of the cathodic protection system. Under this alternate the entire system, including control console, rectifier, anodes, and treatment tank are to be deleted and the piping revised as required for a conventional saltwater system.

SECTION 82 - LIFESAVING EQUIPMENT

All lifesaving equipment except as specifically listed below is to be furnished by the Contractor. Installation and equipment is to be in accordance with the requirements of the U.S. Coast Guard.

LIFE BOATS

One life boat 18 feet long, aluminum, standard model "Welin" or equal, having a capacity of 180 cu. ft. approved for the carriage of 18 persons shall be furnished by the Owners. The boat will be completely equipped with all equipment required by the U. S. Coast Guard, with the exception of a canvas cover. The Contractor is to provide a #4 canvas cover complete with ridgepole, lashing, etc.

DAVITS

One set of Coast Guard approved mechanical crescent davits "Welin" or equal, will be furnished by the Owner for installation by the Contractor. The davits shall be securely bolted to structural steel foundations and the necessary structural reinforcement fitted under the deck in the form of brackets, beams, etc., as required to

take the concentrated deck load.

BOAT GRIPES

Galvanized boat gripes, chain releasing gear, etc., as required to secure the boats to the crescent davits are to be provided by the Contractor.

LIFE BOAT WINCH

The Owners will furnish one "Welin" or equal Coast Guard approved manual lifeboat winch. The Contractor is to install it on a suitable foundation as indicated in the contract plans. The winch handles will be stored on clips adjacent to the winch. The winch shall be operated by a special portable motor as specified in Section 92. The winch drum shall be grooved and the layout from winches and sheaves is to be arranged to keep within the fleeting angle required by the Coast Guard.

BOAT FALLS

The life boat falls are to be provided by the Contractor, consisting of 3/8" 6 x 19 improved plow steel wire rope. Life boat blocks shall be suitable for the size of the rope, the davit and the releasing gear, and lead blocks are to be provided for the leads

of the life boat winch. All blocks shall be "Boston Lockport" with galvanized shells and graphite bronze bearings. Wire rope leads along the deck between the lead box at the base of the davit and the winch are to be protected by 1/8" steel flanged guard plates.

RING LIFE BUOYS

The Contractor shall furnish and install eight ring life buoys on the vessel where directed. Six of the ring buoys shall be furnished with water lights and two shall have secured to them at least 15 fathom of line. The life buoy installation is to be entirely in accordance with the requirements of the U. S. Coast Guard.

LIFE PRESERVERS

The Owners will furnish all life preservers required. The Contractor is to receive and stencil the preservers and to install them. Stowage will generally be underneath the bunks in the staterooms.

LINE THROWING GUN

The Owners will furnish and deliver to the Contractor one line throwing gun, complete with all equipment, of an approved Coast Guard type, complete in a self-contained box. The Contractor shall receive and store the box and place it aboard the vessel on the upper deck and securely fasten it in a suitable clip type foundation.

INFLATABLE LIFE RAFTS

The Contractor will furnish and install two Coast Guard approved inflatable life rafts, "Elliott" or equal, complete with container, mounting cradle, hydrostatic release and equipment for ocean service. Life rafts are to be of fifteen person capacity each, mounted where indicated on the upper deck.

SECTION 87 - INSTRUMENTS & GAUGES

Remote level indicating gauges specified in Section 55 for the fuel oil settling tank shall be a float, direct lift gauge similar to "Liquidometer Corp." Model B 800, employing two separate floats--one to indicate oil level, and the other water level. Indicator shall be similar to Midel B 842, but modified for two pointers.

Gauge for the flume tank will be similar but with a single float. Gauges shown on contract plans for water tanks shall be similar to above, with floats on each water tank and a combined gauge with two pointers in the engine room.

The Contractor is to provide and install all thermometers and pressure gauges, as indicated in the contract plans. The pressure range of the gauges is to be such that the operating pressure is about 1/2 the maximum pressure of the gauge, but shall be high enough to indicate the usual test pressure for the system.

Gauges shall be labeled to show the function of each gauge either on the dial or by enamel filled machine engraved label plates. Thermometers are to be labelled similarly to the gauges to

show the function of each, except where the location is such that the service is apparent.

All pressure gauges shall be "American Marsh", or equal, and shall have not less than 4-1/2" dials. Thermometers shall be mercury thermometers, bare bulb, union connection, 9" scale "Tagliabue", or equal.

SECTION 91 - WORKSHOP FACILITIES

GENERAL

Work benches, stowage racks, and other miscellaneous facilities as called for herein and shown on the contract plans shall be furnished and installed by the Contractor.

WORKBENCHES

1. One workbench approximately 30" wide by seven feet six inches long, 1/4" plate, top flanged down 2", supported on substantial angle iron framework shall be installed in the engine room. Two drawers 24" wide by 8" high by 28" deep, welded 12 gauge steel, shall be installed under this bench.
2. A similar workbench shall be installed by the Contractor in the lazarette space aft of the machinery space. Two drawers as specified for bench No. 1 shall be installed in this particular bench.

STORAGE BINS

Storage bins built of not less than 16 gauge galvanized steel sheet metal shall be installed over each of the work benches specified above. Stowage bins shall be 10" deep by the full length

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STORAGE BINS

Storage bins built of not less than 16 gauge galvanized steel sheet metal shall be installed over each of the work benches specified above. Stowage bins shall be 10" deep by the full length

SECTION 92 - PORTABLE TOOLS & EQUIPMENT

Special wrenches shall be furnished by the Contractor to fit any special nuts such as stern tube and propeller nuts, as well as any special nuts on Contractor-furnished machinery and equipment.

One portable heavy duty electric drill, 115 volt, single phase shall be furnished and stowed aboard the vessel as directed. This drill shall be not less than 1 horsepower provided with a special chock as required to operate the life boat hoist and the turn-out crank on the davits. Ground connections with plugs suitable for use with improved grounded receptacles shall be supplied with the drill.

All hand tools and portable tools to be used aboard the vessel, with the exception of those specified above, shall be Owner furnished and Owner installed.

SECTION 93 - FIRE FIGHTING EQUIPMENT

FIRE HOSE STATIONS

Fire stations located as directed by the U. S. Coast Guard and as generally indicated on the contract plans are to be furnished and installed by the Contractor. Each station shall be filled with one (1) 50' length of 1-1/2" diameter cotton hose, complete with nozzles and spanners. Hose is to be lined in machinery space and exterior locations, unlined elsewhere. Hose racks are to be Navy saddle type.

FIRE EXTINGUISHERS

One 50 lb. CO₂ bottle with hose reel and 50' of hose is to be installed in the machinery space.

Not less than nine (9) portable extinguishers, 2-1/2 gallon foam or 15 lb. CO₂, as required by the U. S. Coast Guard are to be installed where directed.

FIRE AXES

Six fire axes are to be installed on clips where directed.

SAND BOX

One metal 5 cu. ft. sand box is to be installed in the engine room



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